60p

YOUR COMPUTER

NOVEMBER 1982 BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE Vol.2 No.11

Gunpowder plotting: make light work of Dragon, BBC and Spectrum graphics

Clive Sinclair interview – his plans for 1983

Ace reviewed

ZX-81 software survey

Music for Acorns

Vic Night Racer



Win a Jupiter Ace



TI's Home Computer.
Unbeatable value. Unrivalled software.

When you choose a TI Home Computer you're choosing a "real" computer. A computer that can grow with you and your family. A computer that lets you play, invent, discover... that lets your imagination soar.

What makes this possible is our wide range of software. You'll find subjects as simple as "Early Reading" and as complex as "TMS 9900 Assembler Editor." Many of our programs are packaged in our unique Solid State Software™ Command Modules. Some have sound. Others have superb colour graphics. Simply plug them in and begin.

When you want to learn to program for yourself, the TI 99/4A is ready too. TI BASIC is built in. The programming manual is easy to understand, easy to follow every step of the way. You will be amazed to discover how much fun programming can be.

WHAT THE PROFESSIONALS LOOK FOR IN A HOME COMPUTER

Feature	Texas Instruments TI 99/4A
Microprocessor	TMS 9900 16 BIT
Graphics	16 colour, high resolution
Languages	TI-BASIC (built-in), extended BASIC, UCSD – PASCAL, TI-LOGO, Assembler
Memory	16K RAM standard – expandable to max ROM/RAM of 110K
Keyboard	Full size, standard typewriter style
Software	1000 programs to choose from worldwide
Solid State Speech Capability	Yes

And when you're ready to expand your system, we're ready too. Our unique Peripheral Expansion System can house up to seven peripherals without extra cables or clutter. There is even a speech synthesiser that gives your computer a voice.

Sound impressive? Try the TI Home Computer for yourself at your nearest dealer. At around £200 you'll look no further.

TEXAS INSTRUMENTS

YOUR COMPUTER

Cover photograph by Stephen Oliver.

Editor
TOBY WOLPE
Assistant Editor
MEIRION JONES
Staff Writer
SIMON BEESLEY
Sub-editor
PAUL BOND
Editorial Secretary
LYNN COWLING
Editorial: 01-661 3144
Advertisement Manager
PHILIP KIRBY 01-661 3127
Advertisement Executives
BILL ARDLEY 01-661 8484
PETER RICE 01-661 8441
Midlands Office
KEITH SALT 021-356 4838
Northern Office
RON SOUTHALL 061-872 8861
Advertisement Secretary
JEANETTE MACKRELL
Publishing Director
CHRIS HIPWELL

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Subscriptions: U.K. £8 for 12 issues.

Typesetting by In-Step Ltd, London EC1.
Printed by Riverside Press Ltd, Whitstable, Kent.
Published by IPC Electrical-Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telegrams: 892084 BIPRESG. ISSN 0263-0885

EDITORIAL

"Have you finished your homework yet?". It is half past eight as Mrs Smith calls up to her son for the fifth time that evening. As soon as he arrives home from school, he shuts himself away in his room which flickers blue as his ZX-81 sluggishly accepts lines of Basic. Still, she reassures herself, he will soon grow out of it. Last year it was Rubik's cube; next year it will be something different. It is just another one of his fads.

But is home computing just another fad? It is impossible to say exactly how many of the half million ZX-81s sold world-wide are already gathering dust beside the skateboards and Kung Fu magazines. But what is clear is that falling prices have turned home computers into disposable consumer products. If your foray into computing has cost you only £50, you can abandon it with greater equanamity than if you had spent £300.

Nevertheless the parallel between the home computer and the likes of the Hoolahoop breaks down because the micro represents the domestic face of a technology which will pervade our society for many years to come. Unfortunately the aspect of computing which, month after month, will continue to be subject to the whims of fashion is exactly what you use your machine for. We have already seen Pac-Man succeed Space Invaders as the vogue game, in the same way that Space Invaders pushed out the ball and paddle games before it. The original spur for many who decided to buy a computer was that they could save their money from the insatiable appetites of arcade machines by playing the games at home on their own micros. Consequently this has meant that the investment behind the development of the latest arcade games forces home-computer software houses to follow in their path.

Only when new applications are designed specifically to take advantage of the micro's facilities will they be able to cast off their role of dedicated followers of the fashions of other and sometimes older technologies and applications. Once software suppliers overcome the limitations of existing computer languages and, more importantly, start using their imaginations the home computer will come into its own. If this is done home computing may still be a fad but it should be good at least to the end of the century. ■

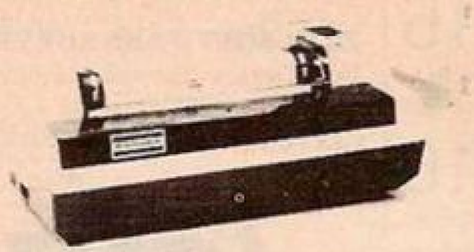
CHROMASONIC electronics

48 JUNCTION ROAD, ARCHWAY, LONDON N19 5RD TEL: 01-263 9493/01-263 9495 TELEX: 22568..

THE HOME COMPUTER SPECIALISTS

VIC 20





VIC PRINTER £185.00
80 Characters per line
30 Characters per sec
Tractor Feed Dot matrix printer



VIC SINGLE FLOPPY DISK
OUR PRICE £335.00
174K Byte Storage
Direct Interface to VIC
Direct Compatibility with printer

VIC 20 COMPUTER
NEW LOW PRICE £147.75
FREE games cartridge supplied with every VIC 20 purchased

VIC CASSETTE DECK £34.00
Free Cassette with 6 programs supplied.

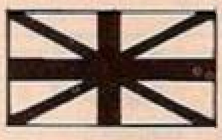
ACCESSORIES FOR YOUR VIC 20

Super Expander High Resolution Cartridge	£27.50
Programmers Aid Cartridge	£27.50
Machine Code Monitor Cartridge	£25.00
8K RAM Cartridge £34.00 16K RAM Cartridge	£59.00

TONS OF SOFTWARE
For a copy of our VIC list containing everying you need for the VIC Computer, just send us your name and address.

DRAGON 32





IT'S BRITISH

*9 Colours *32K RAM memory as Standard, expandable to 64K *Extended Microsoft Colour Basic as Standard *Typewriter Keyboard *6809E CPU *Advanced Sound Feature *32 columns × 16 lines FREE 'Basic' training manual supplied

OUR PRICE £173.00

SPECIAL OFFER GENIE I OR II £249.00 × VAT

COLOUR GENIE

EG2000 PAL VERSION



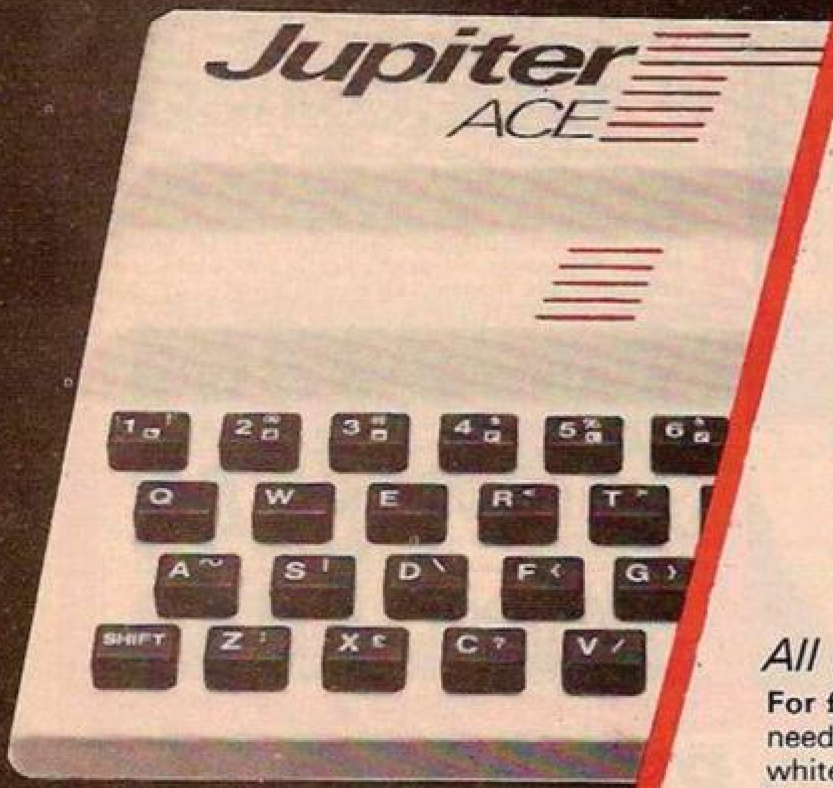
*8 colours *16K RAM std expandable to 32K *Extended Microsoft Colour Basic std *Typewriter Keyboard *CPU: Z80A/2.2MHz *3 sound channels *40 columns × 24 lines *Serial & Parallel YO Ports

OUR PRICE £173.00

I am interested in a home computer, please send me further details
☐VIC 20 ☐Dragon ☐Colour Genie
Name
Address
Y.C.

TERMS OF BUSINESS: Please add 15% VAT to all prices. Delivery charged at cost. Prices valid for cover date of this Magazine. Access and Barclaycard orders welcome.

Jupiter ACE



The Jupiter Ace personal computer runs in FORTH, an easily understood language, typically four times as compact and ten times as fast as BASIC. Before the Ace all personal computers used BASIC and FORTH was only available to a privileged few.

The Jupiter Ace also features a full-size moving-key keyboard, high-resolution graphics, sound, floating point arithmetic, a fast and reliable cassette interface and 3K of RAM.

If you own a personal computer you will be aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled. The Jupiter Ace is your answer.

If you already know FORTH, the Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

All inclusive price

For £89.95 you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual.
The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace.
Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming.
The price includes postage, packing and V.A.T.
The Jupiter Ace is backed by a full 12 month warranty.

"The Ace is an excellent way of using FORTH"
Popular Computing Weekly

Available soon

Plug-on parallel printer interface.
For around £20.00 this will connect your Jupiter Ace to anything from high-speed dot matrix to letter-quality daisy wheel printers.

Plug-on 16K Memory Expansion
For around £30.00 you will increase the memory of your Jupiter Ace to 19K giving you instant access to enormous amounts of information.

Software
A catalogue will be sent with every machine, and includes, initially, programs for education and entertainment.

"FORTH is an easy language"
Byte

FORTH Finishes First!

Speed Comparison Chart showing times in seconds to perform one thousand operations.

Type of Operation	Jupiter Ace	BBC Micro	Vic 20	Spectrum	ZX81
Empty loop	0.12	0.67	1.3	4.2	17.7
Print a number	7.5	13.5	26	19	430
Print a character	0.62	1.3	3.1	7.5	24
Add two numbers	0.45	1.4	5.5	7.5	28
Multiply two numbers	0.9	1.6	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

only £89.95

Designed by Jupiter Cantab

Computer Designers Steven Vickers and Richard Altwasser played a major role in creating the ZX Spectrum and then formed Jupiter Cantab to develop advanced ideas in personal computing. The Ace is the result, another all-British computer to lead the world.

Technical Information

Hardware
Z80A running at 3.25 MHz.
8K bytes ROM
3K bytes RAM

Keyboard
40 Moving-key keyboard with auto repeat on every key and Caps Lock.

Screen
Memory mapped 32 column x 24 line flicker-free display with upper and lower case ascii character set.

Graphics
Chunky graphics (64 x 46 pixels) may be plotted, unplotted or over-plotted (XOR operation). Also, the entire character set (128 characters and their video inverses) may be redefined allowing intricate shapes to be drawn with a resolution equivalent to 256 x 192 pixels.

Control Structures
IF–ELSE–THEN, DO–LOOP DO–+LOOP, BEGIN–WHILE–REPEAT, BEGIN–UNTIL, all may be mixed and nested to any depth.

Cassette
Programs and data in the compact dictionary format may be saved, verified, loaded and merged. Blocks of memory can be saved, verified, loaded and relocated. All tape files are named. Running at 1500 baud, the Ace will connect to most portable tape recorders.

Expansion Port
Contains D.C. power rails and full Z80 Address, data and control signals. May be used to connect extra memory and other peripherals. IN and OUT words allow port-based peripherals to be addressed.

Data Structures
Integer, Floating point and String data may be held as constants, variables or arrays with multiple dimensions and mixed data types. There are no restrictions on names.

Sound
Internal loudspeaker may be programmed to operate over the entire audio spectrum.

Programming in FORTH

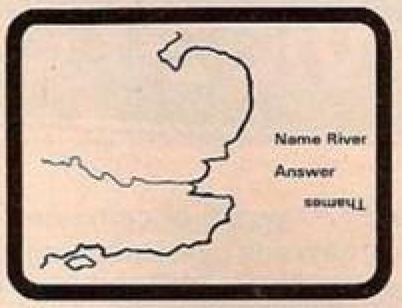
Programming in FORTH

FORTH programs are constructed without line-numbers, as words which are defined in terms of other words that already exist. Consider the following definition of the word **STARS**. Comments are in parenthesis and have no action.

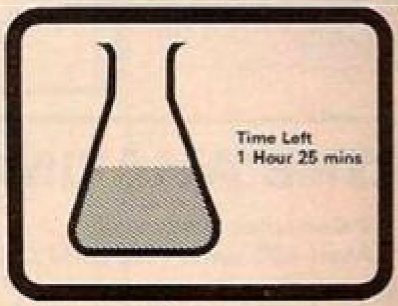
```
: STARS             (: starts word definition)
  " *** "           (print 3 asterisks)
  200 100 BEEP      (play a note for
                     100 mSecs)
;
```

The semi colon at the end finishes the word definition. Now, whenever you say **STARS** the computer will print out 3 asterisks and sound a short tone. (Notice how the word **BEEP** comes after the numbers it uses, 200 and 100. This characteristic occurs throughout FORTH so that you write, for instance, 28 76 + instead of 28 + 76.)

The Jupiter Ace already has 140 FORTH words defined in ROM.



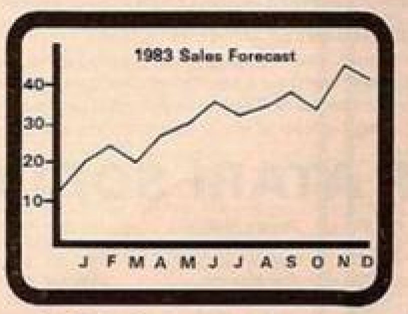
In Schools Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.



At Home The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

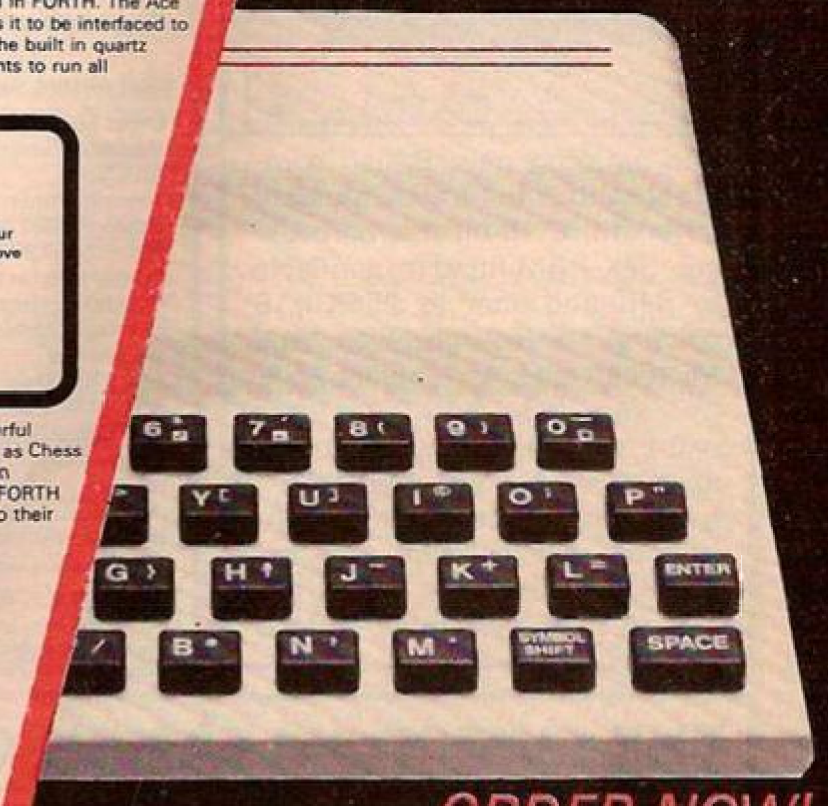
"FORTH is very flexible"

"FORTH is compact"

Electronics and computing

"FORTH is in general very much faster than BASIC"

Computing Today



ORDER NOW!

The **Jupiter Ace** is available only by mail order. Please allow up to 28 days for delivery.
Send cheque or postal order with the form to:—
JUPITER CANTAB, 22 FOXHOLLOW, BAR HILL, CAMBRIDGE CB3 8EP

Please send me:—

☐ JUPITER ACE MICROCOMPUTER(S) @ £89.95.

Name. Mr/ Mrs/Miss ______________________

Address ______________________

______________________ F



INTEREST FREE

On Atari, VIC 20, Commodore 64 and

If your order contains over £120 worth of computer hardware apply now for interest free credit by telephoning: Mail-order: (0702) 552911. London Shop: 01-748 0926. Birmingham Shop: 021-356 7292. Southend Shop: 0702 554000 or write to P.O. Box 3, Rayleigh, Essex SS6 8LR.

You pay 10% down, then 10% per month for a further nine months (to nearest penny). Example: VIC20 Colour Computer. Cash Price £169.99. Credit terms: £16.99 down then £17 per month for nine months: Total £169.99. Credit quotations on request.

THE NEW COMMODORE 64

The incredible new computer from Commodore comes with 64K RAM fitted! Plus 16 colours, hi-res graphics, 320 x 200 pixels, 40 columns by 25 lines, Z80 micro processor can be added — that means you can run CP/M software, 8 independently movable Sprites with collision detection, and a sound generator with 3 voices, 4 waveforms, envelope and filter to rival some dedicated music synthesisers. And all this at the most incredible price ever.

(AF56L) Only £339.00

DRAGON 32



The amazing new British computer with a full-travel standard keyboard, a 16-bit microprocessor, 32K RAM fitted (expandable to 64K and later to 256K!!), 9 colours, hi-res graphics and Microsoft extended colour BASIC (the very best BASIC to learn with). It can be used with virtually any ordinary cassette recorder, it has a printer interface (Centronics-type), joysticks are available and it's incredible value for money. **(AF57M) Only £199.50**

THE AMAZING ATARI COMPUTERS

4 Consoles Available:
Atari 400 with 16K RAM (AF36P) £249.95
Atari 400 with 48K RAM (AF37S) £319.00
Atari 800 with 16K RAM (AF02C) £499.00
Atari 800 with 48K RAM (AF55K) £590.00
★All above with BASIC & handbooks





Other hardware:

Cassette Recorder	(AF28F)	£50.00
Disk Drive	(AF06G)	£299.95
Thermal Printer	(AF04E)	£265.00
Epson MX80T Mk III	(AF38R)	£399.95
Epson MX80F/T Mk III	(AF40T)	£447.35
Printer Interface for 400	(AF41U)	£59.95
Printer Interface for 800	(AF42V)	£59.95
Interface Module	(AF29G)	£135.00
Versawriter	(AF43W)	£199.95
16K RAM Module	(AF08J)	£55.00
48K RAM Module for 400	(AF44X)	£125.35
48K Upgrade for 400	(AF45Y)	£75.00
Floppy Disk	(YX87U)	£2.50
Le Stick	(AC45Y)	£24.95
Joystick Controllers (Pair)	(AC37S)	£13.95
Paddle Controllers (Pair)	(AC30H)	£13.95

For full details ask for our hardware leaflet (XH54J) SAE appreciated

JOIN THE U.K. ATARI COMPUTER OWNERS' CLUB

An independent users' group. Four issues of the club magazine for only £3.00! Address your subscription to Ron. Issue 1 of the club magazine featured a tutorial on character set redefinition and contained a collection of demonstration and games programs and lots more. Issue 2 featured a tutorial on player/missile graphics, an article about graphics on computers, a selection of members' contributions to the program library and much more.

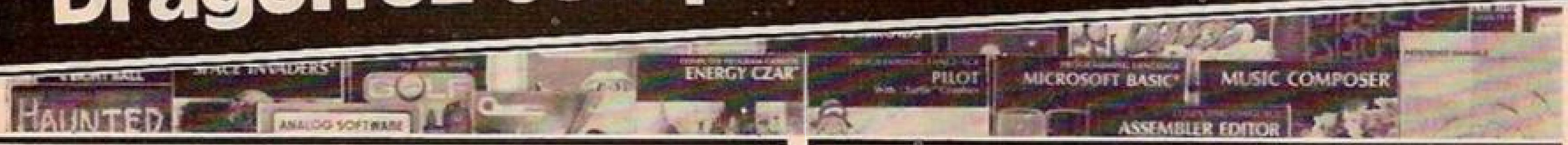
THE FINEST SELECTION OF ATARI SOFTWARE

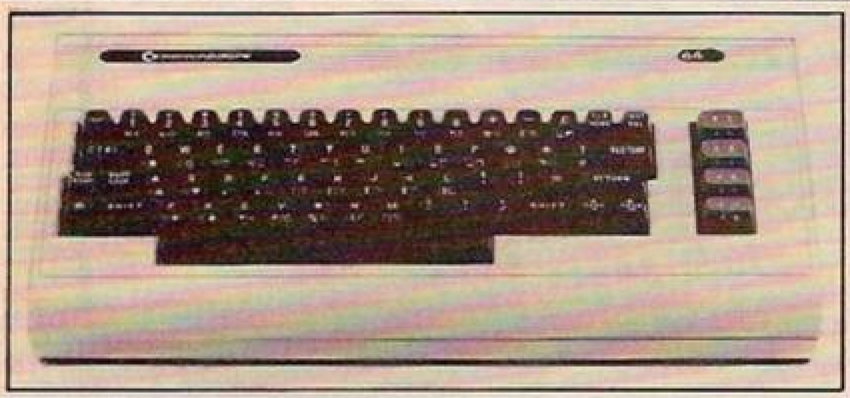
Teach-Yourself Programs		
Conversational French	-5C-16K-YG44X	£39.95
Conversational German	-5C-16K-YG45Y	£39.95
Conversational Spanish	-5C-16K-YG46A	£39.95
Conversational Italian	-5C-16K-YG47B	£39.95
Touch Typing	-2C-16K-YG49D	£15.95
States & Capitals	-1C-16K-YG56L	£9.95
Euro Countries & Capitals	-1C-16K-YG57M	£9.95
Kids 1 (3 Programs)	-1C-16K-BG00A	£9.95
Kids 1 (3 Programs)	-1D-24K-BG01B	£9.95
Kids 2 (3 Programs)	-1C-16K-BG02C	£9.95
Kids 2 (3 Programs)	-1D-24K-BG03D	£9.95
Learn Programming		
Invitation To Programming 1	-1C-8K-YG43W	£15.95
Invitation To Programming 2	-2C-8K-BQ67X	£22.95
Invitation To Programming 3	-2C-8K-BQ68Y	£22.95
Basics Of Animation	-1C-16K-BQ57M	£11.95
Basics Of Animation	-1D-24K-BQ58N	£11.95
Player Missile Graphics	-1C-32K-BQ59P	£18.95
Player Missile Graphics	-1D-32K-BQ60Q	£18.95
Display Lists	-1C-16K-BQ51F	£11.95
Display Lists	-1D-24K-BQ52G	£11.95
Horiz./Vert. Scrolling	-1C-16K-BQ53H	£11.95
Horiz./Vert. Scrolling	-1D-24K-BQ54J	£11.95
Page Flipping	-1C-16K-BQ55K	£11.95
Page Flipping	-1D-24K-BQ56L	£11.95
Sounds & Music	-1C-16K-BG04E	£11.95
Sounds & Music	-1D-24K-BG05F	£11.95
Tricky Tutorials	-3C-32K-BG06G	£59.95
Tricky Tutorials	-3D-32K-BG07H	£59.95
Business Programs		
Visicalc	-1D-32K-YL39N	£119.95
Atari Word Processor	-1C&3D-48K-YG42V	£99.95
Text Wizard	-1D-32K-BQ99H	£69.95
Mini Word Processor	-1C-32K-BG08J	£11.95
Mini Word Processor	-1D-32K-BG09K	£11.95
Calculator	-1D-24K-YG50E	£16.95
Graph-it	-2C-16K-YG51F	£13.95
Statistics	-1C-16K-YG52G	£13.95
Personal Financial Management	-3D-32K-BQ65V	£49.00
Mortgage & Loan Analysis	-1C-16K-BQ66W	£13.95
Bob's Business	-1C-32K-BG11M	£9.95
Bob's Business	-1D-32K-BG12N	£9.95
Adventure Games		
Galactic Empire	-1C-32K-BQ14Q	£14.95
Rescue At Rigel	-1C-32K-BQ21X	£22.45
Rescue At Rigel	-1D-32K-BQ80B	£22.45
Datestones Of Ryn	-1C-32K-BQ22Y	£14.95
Datestones Of Ryn	-1D-32K-BQ82D	£14.95
Star Warrior	-1C-32K-BQ24B	£28.95
Star Warrior	-1D-32K-BQ79L	£28.95
Invasion Orion	-1C-24K-BQ23A	£18.95
Invasion Orion	-1D-32K-BQ81C	£18.95
Star Trek 3.5	-1C-32K-BQ15R	£14.95
Star Trek 3.5	-1D-40K-BG26D	£18.95
Crush, Crumble & Chomp	-1C-32K-BQ83E	£22.45
Crush, Crumble & Chomp	-1D-32K-BQ84F	£22.45
Mission: Asteroid	-1D-40K-BQ91Y	£17.19
Wizard & The Princess	-1D-40K-BQ25C	£21.79
Ulysses & The Golden Fleece	-2D-40K-BQ92A	£20.64
Zork I	-1D-32K-BQ94C	£29.95
Zork II	-1D-32K-BQ95D	£29.95
Ali Baba & The 40 Thieves	-1D-32K-BQ78K	£27.95
Temple Of Apshai (Part 1)	-1C-32K-BQ85G	£28.95
Temple Of Apshai (Part 1)	-1D-32K-BQ86T	£28.95
Upper Reaches Of Apshai (Part 2)	-1C-32K-BQ87U	£14.95
Upper Reaches Of Apshai (Part 2)	-1D-32K-BQ88V	£14.95
Curse Of Ra (Part 3)	-1C-32K-BQ89W	£14.95
Curse Of Ra (Part 3)	-1D-32K-BQ90X	£14.95
Analog Adventure	-1D-32K-BQ33L	£16.95
Adventure Land	-1C-24K-BQ00A	£14.95
Pirates Adventure	-1C-24K-BQ01B	£14.95
Mission Impossible	-1C-24K-BC02C	£14.95
Voodoo Castle	-1C-24K-BQ03D	£14.95
The Count	-1C-24K-BQ04E	£14.95
Strange Odyssey	-1C-24K-BQ05F	£14.95
Mystery Fun House	-1C-24K-BQ06G	£14.95
Pyramid Of Doom	-1C-24K-BQ07H	£14.95
Ghost Town	-1C-24K-BQ08J	£14.95
Savage Island I	-1C-24K-BQ09K	£14.95
Savage Island II	-1C-24K-BQ10L	£14.95
Golden Voyage	-1C-24K-BQ11M	£14.95
Softporn Adventure	-1D-40K-BQ93B	£20.64
Deadline	-2D-32K-BQ96E	£34.95
The Shattered Alliance	-1D-48K-BQ98G	£29.95
The Battle Of Shiloh	-1C-40K-BQ63T	£29.95
The Battle Of Shiloh	-1D-40K-BQ97F	£29.95
Energy Czar	-1C-16K-YG53H	£9.95
Kingdom	-1C-8K-YG55K	£9.95
Space Shuttle Module 1	-1D-32K-BG65V	£19.95
Arcade Games		
Star Raiders	-1E-8K-YG66W	£29.95

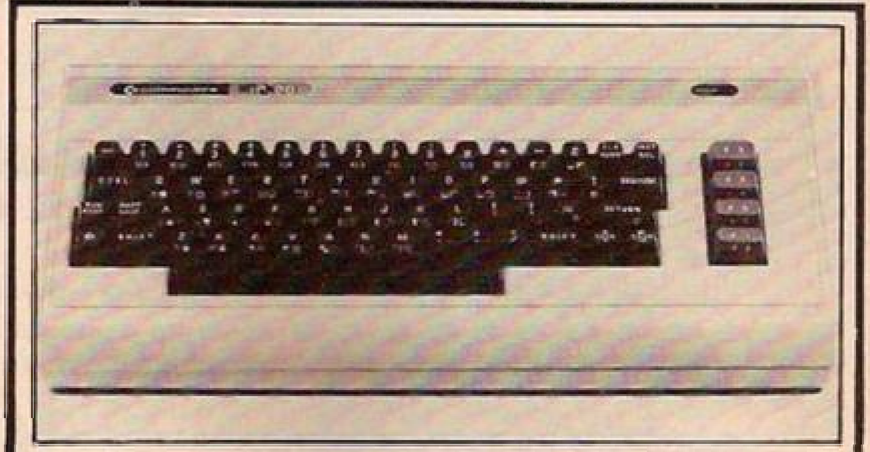
CREDIT

(Subject to approval which can take up to 48 hours) (APR = 0%)

Dragon 32 computer hardware







ATARI SOFTWARE continued

Asteroids	-1E-8K-YG60Q	£29.95
Space Invaders	-1E-8K-YG70M	£29.95
Missile Command	-1E-8K-YG64U	£29.95
Caverns of Mars	-1D-16K-BQ69A	£24.50
K-Razy Shoot Out	-1E-8K-BQ63T	£29.95
K-Razy Kritters	-1E-8K-BG51F	£29.95
K-Star Patrol	-1E-8K-BG52G	£29.95
Pathfinder	-1D-32K-BG33L	£27.95
Crossfire	-1C-16K-BG22Y	£20.64
Crossfire	-1D-32K-BG23A	£20.64
Protector	-1C-32K-BG24B	£21.80
Protector	-1D-32K-BG25C	£21.80
Threshold	-1D-40K-BG18U	£27.54
Deluxe Invaders	-1D-16K-BG34M	£29.95
Galactic Chase	-1C-16K-BQ62S	£16.95
Galactic Chase	-1D-16K-BQ61R	£19.95
Race In Space	-1C-16K-BQ35Q	£14.95
Race In Space	-1D-16K-BG20W	£16.95
Space Chase	-1C-16K-BG42V	£10.95
Space Chase	-1D-24K-BG43W	£12.95
Centipede	-1E-16K-BQ70M	£29.95
Angle Worms	-1C-8K-BG50E	£10.95
Lunar Lander	-1C-24K-BQ16S	£10.95
Lunar Lander	-1D-24K-BG49D	£14.95
Jumbo Jet Lander	Available November	
Submarine Commander	Available November	
Rasterblaster	-1D-32K-BG35Q	£22.95
Shooting Gallery	-1C-16K-BQ36P	£14.95
Shooting Gallery	-1D-16K-BG19V	£16.95
Shooting Arcade	-1C-16K-BG15R	£24.95
Shooting Arcade	-1D-16K-BG16S	£24.95
Super Breakout	-1E-8K-YG67X	£24.50
Dodge Racer	-1C-16K-BG29G	£19.95
Dodge Racer	-1D-24K-BG30H	£19.95
Matchracer	-1C-16K-BG31J	£23.95
Matchracer	-1D-16K-BG32K	£23.95
Mouskattack	-1D-32K-BQ77J	£22.95
Jawbreaker	-1C-16K-BG17T	£20.64
Jawbreaker	-1D-32K-BQ26D	£20.64
Ghost Hunter	-1C-16K-BQ64U	£19.95
Pac-Man	-1E-8K-BQ71N	£29.95
Pacific Coast Highway	-1C-16K-BG13P	£24.95
Pacific Coast Highway	-1D-16K-BG14Q	£24.95
Chicken	-1C-16K-BG27E	£21.80
Chicken	-1D-16K-BG28F	£21.80
Tumble Bugs	-1D-24K-BG46A	£24.95
Bug Attack	-1C-24K-BG36P	£23.95
Bug Attack	-1D-40K-BG37S	£23.95
Canyon Climber	-1C-16K-BG44X	£24.95
Canyon Climber	-1D-16K-BG45Y	£24.95
Mountain Shoot	-1C-16K-BQ12N	£10.95
Haunted Hill	-1C-16K-BG38R	£16.95
Haunted Hill	-1D-16K-BG39N	£19.95
Time Bomb	-1C-16K-BG40T	£10.95
Time Bomb	-1D-24K-BG41U	£12.95
Tank Trap	-1C-16K-YL34M	£9.95
Tank Trap	-1D-32K-YL35Q	£12.95
Thunder Island	-1C-16K-BQ37S	£10.95

Home Game Programs

Scram	-1C-16/24K-YG58N	£17.50
Basketball	-1E-8K-YG61R	£24.50
Cypher Bowl	-1C-16K-BQ20W	£29.50
Sunday Golf	-1C-16K-BQ13P	£10.95
Darts	-1C-16K-BQ42V	£19.95
Tournament & 8-Ball Pool	-1C-16K-BQ45Y	£19.95
Snooker & Billiards	-1C-16K-BQ44X	£19.95
Ricochet	-1C-16K-BG47B	£14.95
Ricochet	-1D-32K-BG48C	£14.95
Computer Chess	-1E-8K-YG63T	£24.50
Fast Gammon	-1C-8K-YL33L	£16.95
Gomoku	-1C-16K-BQ18U	£14.95
Gomoku	-1D-16K-BG55K	£19.95
Reversi	-1C-16K-BQ19V	£14.95
Reversi	-1D-16K-BG54J	£19.95
Cribbage & Dominoes	-1C-16K-BQ43W	£14.95
Poker Solitaire	-1C-16K-BQ17T	£10.95
Poker Solitaire	-1D-16K-BG53H	£14.95

Blackjack	-1C-8K-YG62S	£9.95
Hangman	-1C-8K-YG54J	£9.95
Super Cubes & Tilt	-1C-16K-BQ48C	£14.95
Humpty Dumpty & Jack & Jill	-1C-16K-BQ38R	£19.95
Hickory Dickory Dock & Baa Baa Black Sheep	-1C-16K-BQ39N	£19.95
British Heritage Jigsaw Puzzles	-2C-16K-BQ40T	£19.95
European Scene Jigsaw Puzzles	-2C-16K-BQ41U	£19.95
Video Easel	-1E-8K-BQ72P	£24.50
Micro Painter	-1D-48K-BG56L	£29.95

Music Programs

Music Composer	-1E-8K-YG48C	£35.95
Movie Themes	-1C-8K-BQ34M	£9.95

Computer Languages

Assembler	-1C-16K-YL32K	£19.95
Assembler Editor	-1E-8K-YG68Y	£39.95
Macro Assembler	-1D-32K-BQ73Q	£59.95
Basic A+	-1D-48K-BQ31J	£49.95
Basic A+ & Operating System A+	-1D-48K-BQ32K	£99.50
Microsoft Basic	-1D-32K-BQ74R	£59.95
Pilot (Educator)	-1E & 2C-16K-BQ75S	£79.95
Pilot (Consumer)	-1E-8K-YG69A	£54.00
QS Forth	-1D-24K-YL29G	£49.95
Tiny-C	-1D-48K-BG62S	£64.95
Inter-Lisp/65	-1D-48K-BG61R	£87.00

Utilities

Programming Aids Package 1	-1C-16K-BG60Q	£ 9.95
6502 Disassembler	-1C-8K-YL30H	£9.95
6502 Disassembler	-1D-8K-YL31J	£12.95
Atari World	-1D-40K-BQ27E	£43.95
3D Supergraphics	-1C-40K-BQ29G	£29.95
3D Supergraphics	-1D-40K-BQ28F	£29.95
File-It 2	-1D-48K-BG10L	£34.95
Filemanager 800	-1D-40K-BG59P	£72.80
K-DOS	-1D-32K-BQ76H	£49.95
Disk Manager	-1D-32K-BG58N	£21.80
Disk Detective	-1D-16K-BG57M	£24.95
Operating System A+	-1D-32K-BQ30H	£49.95
Telelink	-1E-8K-YG59P	£21.50
The Next Step	-1D-32K-BG64U	£27.54

Books

Master Memory Map	-XH57M	£4.00
De Re Atari	-WG56L	£16.95
Operating System User's Manual & Hardware Manual	-WA46A	£16.95
Atari Basic-Learning By Using	-WG55K	£5.24
Games For The Atari	-WA47B	£4.45
Atari Basic	-WG05F	£6.80
Atari Sound & Graphics	-WA39N	£8.25
Your Atari Computer	-WA40T	£13.45
6502 Assembly Language Subroutines	-WA05F	£12.45
Advanced 6502 Interfacing	-WA41U	£11.45
Beyond Games (6502)	-WA45Y	£13.00
Computers For People	-WA00A	£8.25
Analog. The Magazine For Atari (6 issues) Annual Subscription	-GG24B	£9.00

Send sae now for our new software leaflet with details of all the above programs.

Order As XH52G — Issue 3.

Key: C = Cassette. D = Disk. E = Cartridge. 2C = 2 Cassettes etc. 8K, 16K shows minimum memory requirement.

Note: Order codes shown in brackets. Prices correct at time of going to press. (Errors excluded).

VIC20 COLOUR COMPUTER

Hardware

VIC20 Console	(AF47B)	£169.99
C2N Cassette Unit	(AF48C)	£44.95
VIC Printer	(AF49D)	£230.00
VIC Disk Drive	(AF50E)	£396.00
3K RAM Cartridge	(AF51F)	£29.95
8K RAM Cartridge	(AF52G)	£44.95
16k RAM Cartridge	(AF53H)	£74.95

Joysticks and Paddles

Single Joystick	(AC53H)	£7.50
Pair of Joysticks	(AC37S)	£13.95
Le Stick	(AC45Y)	£24.95
Pair of Paddles	(AC30H)	£13.95

Programming Aid Cartridges

Super Expander: 3K RAM and Hi-res graphics	(AC54J)	£34.95
Programming Aid: Additional commands, function Key programming etc.	(AC55K)	£34.95
Machine Code Monitor	(AC56L)	£34.95

Software (all 3K unless stated)

Introduction to BASIC Cassettes

Part 1	(AC57M)	£14.95
Part 2	(AC58N)	£14.95

Game Programs

Avenger Cartridge	(AC59P)	£19.95
Star Battle Cartridge	(AC60Q)	£19.95
Super Slot Cartridge	(AC61R)	£19.95
Jelly Monsters Cartridge	(AC62S)	£19.95
Alien Cartridge	(AC63T)	£19.95
Super Lander Cartridge	(AC64U)	£19.95
Road Race Cartridge	(AC65V)	£19.95
Rat Race Cartridge	(AC66W)	£19.95
Blitz Cassette	(AC67X)	£4.99
Mole Attack Cartridge	(AC85G)	£24.95
Adventureland Cartridge	(AC86T)	£24.95
Pirate Cove Cartridge	(AC84F)	£24.95
Mission Impossible Cartridge	(AC87U)	£24.95
Voodoo Castle Cartridge	(AC88V)	£24.95
The Count Cartridge	(AC89W)	£24.95
Sargon 2 Chess Cartridge	(AC77J)	£24.95
Gorf Cartridge	(AC90X)	£24.95
Omega Race Cartridge	(AC91Y)	£24.95
Another VIC in The Wall Cassette	(AC78K)	£7.00
VIC Panic Cassette	(AC79L)	£7.00
Cosmiads Cassette	(AC80B)	£7.00
Backgammon Cassette (+3K)	(AC81C)	£7.00
VIC-Men Cassette	(AC82D)	£7.00
VIC Asteroids Cassette	(AC83E)	£7.00

Business Programs

Simplicalc Disk (+16K)	(AC92A)	£24.95
Simplicalc Cassette (+16K)	(AC93B)	£19.95
VIC Stock Control Cassette (+8K)	(AC94C)	£19.95
VIC File Disk (+16K)	(AC95D)	£24.95
VIC Writer Disk (+8K)	(AC96E)	£24.95
VIC Writer Cassette (+8K)	(AC97F)	£19.95

Education (CSE & GCE 'O' Level Revision)

All cassette based and require at least 8K expansion memory

English Language	(AC98G)	£9.99
Mathematics 1	(AC99H)	£9.99
Mathematics 2	(BC00A)	£9.99
Biology	(BC01B)	£9.99
Chemistry	(BC02C)	£9.99
Physics	(BC03D)	£9.99
Computer Studies	(BC04E)	£9.99
Geography	(BC05F)	£9.99
History	(BC06G)	£9.99
Arithmetic for 9 to 11 year olds	(BC07H)	£9.99
Reading for 9 to 11 year olds	(BC08J)	£9.99
General Knowledge for 9 to 11 year olds	(BC09K)	£9.99
Spelling for 9 to 11 year olds	(BC10L)	£9.99

Home Programs

All cassette based and require at least 8K expansion memory

Quizmaster	(BC11M)	£9.99
Know Your Own IQ	(BC12N)	£9.99
Junior IQ	(BC13P)	£9.99
Know Your Own Personality	(BC14Q)	£9.99
The Robert Carrier Family Menu Planner	(BC15R)	£9.99
VIC Money Manager	(BC16S)	£9.99
VIC Road User & Highway Code	(BC17T)	£9.99
Garden Planner	(BC18U)	£9.99
Interior Designer	(BC19V)	£9.99
BBC "Ask The Family"	(BC20W)	£9.99
BBC "Mastermind"	(BC21X)	£9.99
"Mastermind" additional General Knowledge		
Data 1	(BC22Y)	£2.50
Data 2	(BC23A)	£2.50
Data 3	(BC24B)	£2.50
Data 4	(BC25C)	£2.50
"Mastermind" additional Specialist Knowledge		
Wine & Food	(BC26D)	£2.50
Music	(BC27E)	£2.50
Sport & Games	(BC28F)	£2.50
Films & TV	(BC29G)	£2.50

Books About VIC

Learn Programming on the VIC	(WA31J)	£2.50
VIC Revealed	(WA32K)	£10.00
VIC Programmers Reference Guide	(WA33L)	£9.95
VIC Graphics	(WA48C)	£10.00

MAPLIN

Maplin Electronic Supplies Ltd., P.O. Box 3, Rayleigh, Essex. Tel: Southend (0702) 552911/554155.

**Demonstrations at our shops NOW. See the computers in action at 159-161 King St., Hammersmith W6. Tel: 01-748 0926
284 London Road, Westcliff-on-Sea, Essex. Tel: (0702) 554000
Lynton Square, Perry Barr, Birmingham: Tel: (021) 356 7292.**

AMSOFT

ANNOUNCE

A NEW RANGE OF ZX81 AND SPECTRUM SOFTWARE PRODUCTS FOR THE DISCERNING USER

Amersham Software Ltd exists to provide software for those users who wish to develop the full potential of their ZX81 and Spectrum computers in the simplest and most effective way, without costly and unreliable hardware changes.

All **AMSOFT** products are designed to work using standard Sinclair equipment, but can be used to generate software for any other devices as well. The range will include assemblers, relocating loaders, compilers, etc. running under a standard monitor system, as well as file handling software to allow Basic users to handle data files.

The first two products are available now:

AM-ZXMON a superb machine code Monitor for the ZX81 allows entry, alteration, movement, verification and execution of machine code programs. The contents of any location or block of locations can be displayed on the screen or printer and user programs can contain breakpoints which allow examination or alteration of the Z80 registers and memory. A special feature allows individual program sections to be saved and loaded on cassettes, and merged together, providing machine code software library facilities. All **AMSOFT** compilers, etc. will be compatible with **AM-ZXMON.**

Superb value at £5.75 inc. VAT

AM-ZXFILE allows the Basic user to create and read back data files to and from cassettes. Users can specify the number of records per block written, the block sizes, and the length of the inter-block gaps. Records can be fixed or variable in length and are created in or transferred to a Basic string array.

Provides the facilities of a large machine at £3.50 inc. VAT

TO: **AMERSHAM SOFTWARE LTD, LONG ROOF, HERVINES ROAD, AMERSHAM, BUCKS. HP6 5MS.**

SEE US ON STAND V34 AT THE Northern Computer Fair

Please send me .... ☐ AM-ZXMON

and .... ☐ AM-ZXFILE

I enclose my cheque/postal order for £........................ made payable to Amersham Software Ltd.

NAME..

ADDRESS..

....

.... YC11

NEW from our BBC micros accessories range



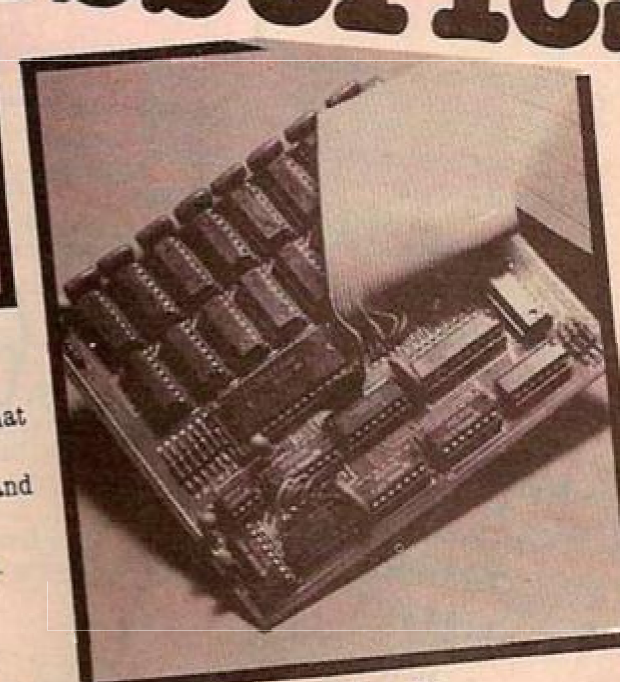


Light Pen

A complete program with plug-in light pen that will draw on the screen.
Ideal for games, graphics origination and commercial uses.
Fabulous value at **£30** plus VAT plus £1 p & p.

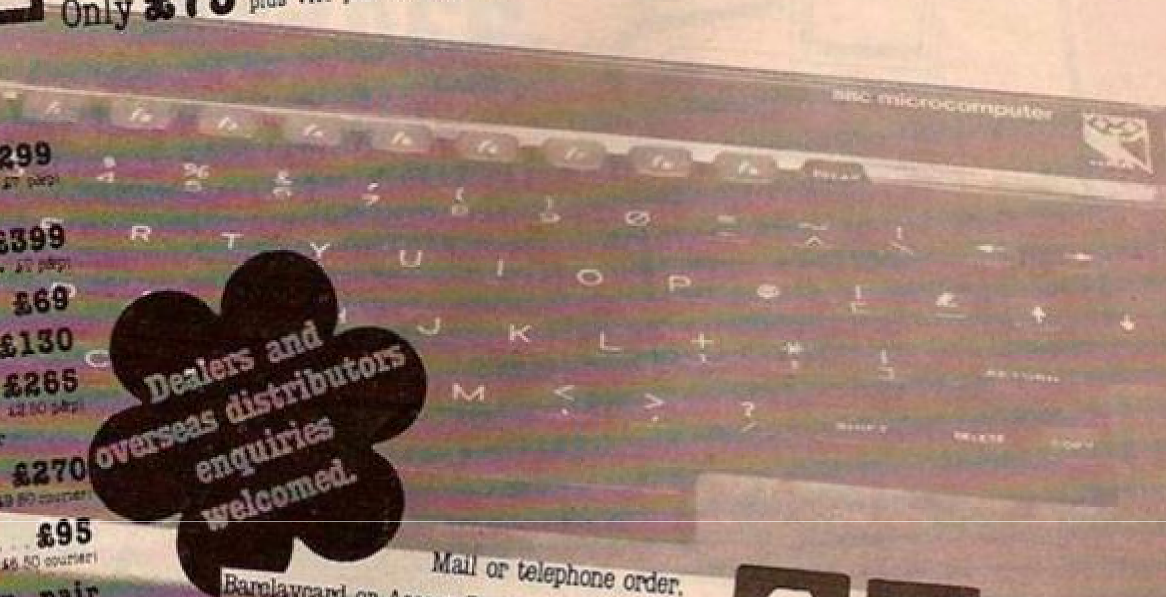
Graphics Tablet

Transfer your technical drawings or designs from pad to screen in seconds, and in colour.
Size 30" square.
Measures distances and areas and moves drawings on screen.
Only **£75** plus VAT plus £4.50 p & p.



128K Ram Pack

Simple plug-in memory expansion board, addressable for your own programs.
Introductory offer **£230** plus VAT plus £1 p & p.



BBC HARDWARE

Model 'A'
16K RAM 32K ROM. Full colour, high resolution .... **£299** (+ £7 p&p)
graphics ....
Model 'B' 32K RAM 32K ROM 16 Colour Graphics .... **£399** (+ £7 p&p)
Tablet **£69**
BBC Disk Interface **£130**
BBC 'B' Upgrade kit .... **£265** (+ £2.50 p&p)
BBC Single Disk Drive 100K bytes ....
14" RGB Colour Monitor (as used in the BBC computer .... **£270** (+ £9.50 courier)
programme) .... **£95** (+ £6.50 courier)
12" Green Monitor ....
.... **£13 p. pair** (+ £1 p&p)
BBC Joystick .... **£288** (+ £4.50 p&p)
Acorn GP 100A Printer ....
Epson MX80 FT111 Printer New model, dot matrix, high .... **£399** (+ £4.50 p&p)
res. graphics 80 or 132 char's per line .... **£15** (+ £1 p&p)
Printer Cable (parallel) ....

Dealers and overseas distributors enquiries welcomed.

Mail or telephone order.
Barclaycard or Access Credit card accepted.

VISA

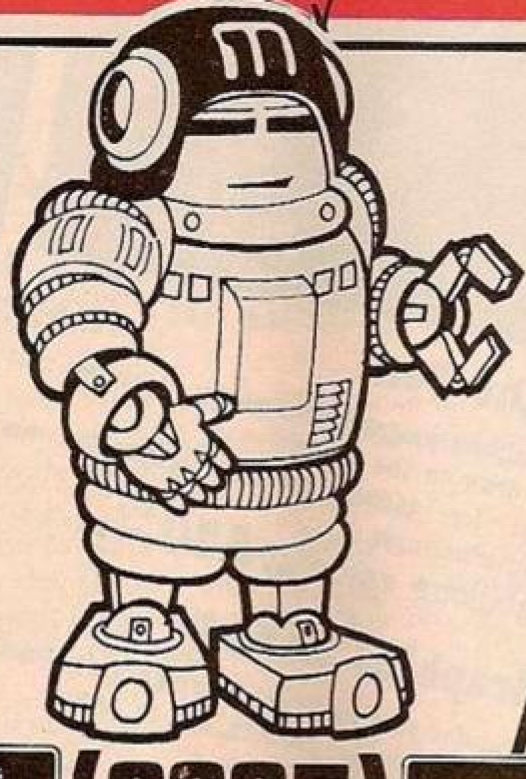
MICRO MANAGEMENT

Micro Management, 32 Princes Street, IPSWICH. Telephone 59181

MicroStyle

29 BELVEDERE, LANSDOWN ROAD, BATH
47 CHEAP STREET, NEWBURY
67 HIGH STREET, DAVENTRY

NEW SHOP WILL OPEN IN NEWBURY IN SEPTEMBER



SEIKOSHA GP100A PRINTER

ENTIRELY NEW DESIGN. UNBELIEVABLY LOW PRICE. FULL GRAPHICS CAPABILITY. CENTRONICS PARALLEL INTERFACE. PAPER WIDTH ADJUSTABLE UP TO 10".

£195.00 + VAT



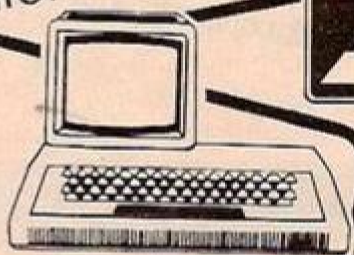
PRINTERS

EPSON MX80
EPSON MX100
ANADEX
PAPER TIGER
T.E.C.
SCRIPTA
MICROLINE 80.



SHARP
MZ 80A & MZ 80B
ALWAYS ON DISPLAY

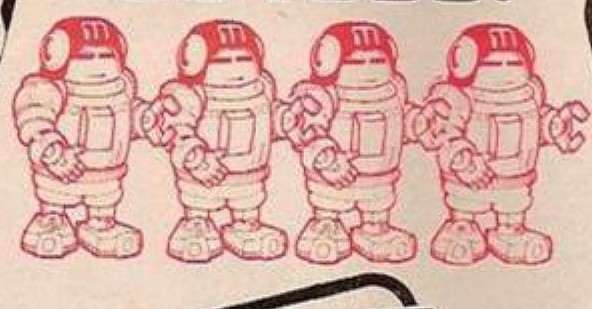
Access **(0225) 334659.** VISA



ACORN ATOM

Sensational New Micro-Pack! 8K ROM 5K RAM, PSU included. Colour fitted. Starter pack software.

£170.00 + VAT





THE TI-99/4A FROM TEXAS INSTRUMENTS.

- 16K RAM (Expandable to 48K)
- Keyboard: 48 key QUERTY
- Sound: 5 octaves, 3 simultaneous tones plus noise generation
- Colours: 16.
- Resolution: 192 x 256 (24 x 32 characters)
- Built-in software: 14K byte BASIC interpreter.

Vast range of Educational and Pre-school early learning modules!

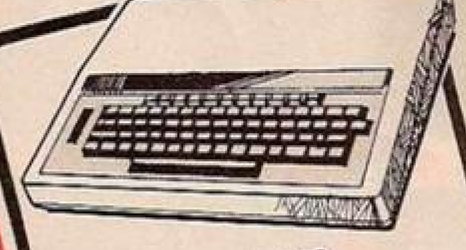
£199 incl. VAT

VIDEO MONITORS

All sizes and prices.
Black/white 9" **£90.00**
Black/white 12" **£65.00**
Green Screen 12" **£85.00**
Amber 9" **£95.00**
All Plus VAT

BBC — COMPATIBLE COLOUR MONITOR £225 + VAT

EXTENSIVE RANGE OF BOOKS AND SOFTWARE ALSO AVAILABLE



BBC MICROCOMPUTER SYSTEM

Complete BBC support: books — software — peripherals
Model "B" ex-stock

Plus Lots More.

Post to:
MICROSTYLE, FREEPOST,
29 Belvedere, Lansdown Road, Bath BA1 1FP

Please send me further details on the following, and your special offers:

. . . .

. . . .

Name . . . .

Company . . . .

Address . . . .

. . . .

. . . . Tel . . . .

YOUR LETTERS

SWISS HELP

Much has been written about problems met by ZX-81 owners during loading and saving programs. I learned the following three rules the hard way, after trouble-free loading since August 1981:

First, if the cassette recorder can run on batteries as well as the main supply, remove the batteries when loading/saving with the mains electric supply. The batteries cause the signal to be very blunt and the ZX does not accept them.

Second, never store your cassettes too near the TV set — the TV set has a magnet in it!

Third, use a cassette-tape head-cleaner regularly. I very nearly lost my favourite game because of a dirty tape head. The signal gets distorted and is incorrectly transmitted.

I must thank your contributors: C J Young for his fantastic Assault Craft, June 82, Julian Stradling for his addictive Patience, August 82 — my favourite game almost lost — and your third contributor on my list Garry Owens for his very clever Landscape, September 82. Your magazine gives me immense pleasure, and I shall definitely renew my order next Spring, whether my Spectrum, ordered by a pal in England in June, is here or not.

Mrs Dane Kurth-Rowe,
Busswil,
Switzerland.

6502 ERRORS

The listing of my 6502 assembler in *Your Computer* September issue contained three errors. The following lines should read:

```
50 IF LEFT$ (C$ (F),1)="B"AND
LEFT$ (C$(F),3) <> "BIT" THEN...etc.
2540 IF LEFT$(A$(A),1)="B"AND
LEFT$ (A$(A), 3)<>"BIT" THEN... etc.
2500 IF D2 >=65535 THEN GOSUB
720: GOTO 1440
```

I would also like to point out that other commands can easily be added to the assembler in the routine from line 1410 to line 1640 — for example a routine could be added to verify tape saves.

Philip Horton,
Evesham,
Worcestershire.

DISGRUNTLED

Two things annoy me: the attitude of schools to the computer they choose, and letters to *Your Computer* from owners of Atom or BBC machines.

First the educational authorities' attitude. Where is the logic in buying a machine such as the Pet at around £350 when several cheaper machines could be bought for the same price? It is obvious that the Pet is superior to, say, the ZX-18, But the idea of computers in schools is to enable as many pupils as possible to learn something about computers and programming.

Regrettably the education authorities will still plump for machines such as the Pet merely because they are dearer. The reason for this is simply that the schools are given a grant for items and if the grant isn't spent in one year, then next year the estimate of the grant is reduced. The simplest, and best, way for the pupils, is to allow schools to spend the grant on more than one machine.

The superior attitude of Atom and BBC owners would appear to be based on the fact that they have purchased an expensive machine. But these machines have a non-standard language which is therefore of little use as far as learning to program is concerned. Whilst admitting that Atom Basic is very fast, it is still too slow for Space Invader games.

G A Bobker,
Bury,
Lancashire.

ZX SNATCHER

I wonder low long Mrs Thatcher had to wait for the Spectrum that she gave to the Japanese. I ordered mine at the end of May, and still there is no expected delivery date put on my order. So, at least in my case, Mr Sinclair cannot even fulfill his promise of delivery 12 weeks after receipt of the confirmation of the order. With the prevailing sellers' market, roll on a serious competitor to Sinclair Research Ltd.

I hope Mrs Thatcher did not receive the computer intended for me.

Gordon Scott,
Sheffield.

SAVING GRACE

When programs are to be Saved with new or changed data after operation, on ZX-81s this routine is useful. In the example, the Saving part of the program takes place at Lines 190 to 210. Line 2 can be typed in as it reads — no Loader routine is required in this case:

```
01 GOTO VAL "100"
02 REM 116252585500405250535857425
   5511004538560051525700533846410
   0050420043525500506200555258574
   6514256005358394946564542410
   0465100000000115652435760385542
   0 0434649422711TAN
100 SLOW
110 FOR J=1 TO 159 STEP 2
120 LET K=USR 16686
130 LET X$=CHR$ PEEK (16525+J)
   +CHR$ PEEK (16526+J)
140 PRINT CHR$ VALX$;
150 NEXT J
160 PRINT ,,,
170 IF INKEY$="" THEN GOTO 170
180 REM SAVE PROGRAM
190 LET X$=""
200 IF INKEY$="S"THEN INPUT X$
210 IF X$>"" THEN SAVE X$
220 IF INKEY$=" STOP " THEN
STOP
999 RUN
```

To Save, when the program is running, press key S. This gives a string input, into which a program name is entered. The tape recorder should then be turned on before Newline is pressed. Note that, in this case, pressing Stop will Stop the program, and any other Control Lines can be written in after Line 220.

Nick Godwin,
Eyemouth,
Berwickshire.

BBC FREEZE

In my opinion one of the most useful facilities on the BBC Micro is that while scanning through a listing, it is possible to freeze the screen by holding down Ctrl & Shift at the same time. The screen will stay in the same position as long as the keys are depressed, and Scrolling will continue when they are let go. The other tip is concerning a fault in the BBC machine. A command word like List, or New cannot be put into a program line, so:

```
100 LIST
```

would give a Syntax Error message. There is, however, a way of getting round this, which is as follows:

```
100 ON ERROR LIST
110 ERROR
```

This method can also be used for New.

David Machin,
Longton,
Stoke-on-Trent.

ATARI IDEAS

It was interesting to see Graphic recall for the Atari in *Your Computer's* October issue, page 93; but it requires more explanation.

First, the program as printed does not draw a rectangle, it draws two straight lines. The listing here does draw a rectangle:

```
10 GRAPHICS 8
15 SETCOLOR 2,2,2:COLOR 1
20 PLOT 20,20:DRAWTO 200,20:
   DRAWTO 200,150:DRAWTO
   20,150:DRAWTO 20,20
```

Note that I have added a Setcolor command to provide a red background. The Color 1 instruction in the original program could be deleted. In Atari Basic, there's no point in using a Color command unless you already have a Setcolor command.

Typing Graphics 1000 does indeed reveal the disappeared rectangle, though more by accident than design.

The Atari uses a Graphics instruction from 0 to 11 to set the Screen Mode — colours available and resolution. In Modes 0 to 8 inclusive the straightforward Graphics command leaves a four line text window at the bottom of the screen. Adding 16 to the graphics command removes this window. The command could be issued as GR.8+16, or as GR.24.

Now, adding 32 to the graphics command removes the text window but also protects the Screen RAM, where the image is stored, so that it is just refreshed. Thus to get the effect noticed by Tony Gillett, you just need to use GR.8+32.

With regard to the comments about Get, some readers may be confused by Com, which Tony Gillett uses in his Line, but this only means Dim, which is the preferred word. In Atari Basic, Get always returns a numeric value. However, it is not necessary to assign the value to a string if a letter is required: Print CHR$(A) will often do. For example:

```
10 OPEN # 1,4,0,"K:":GET
   # 1,A:PRINT CHR$(A):CLOSE
   # 1
```

Goodness knows why anyone would want to do this.

However, it is interesting to find someone who can tear himself away from the world's best computer game, Star Raiders, for long enough to look at Atari Basic. Maybe some more readers will now send in their ideas.

Jack Schofield,
Sutton,
Surrey.

REASSEMBLE

There are four mistakes in the YC October Spectrum assembler tables. The corrections are as follows:

Line 1801: 15th item along was: "D=M": this should be "D@M"': 38th item along was "7HG" this should read "7HJ".

Line 1804: last item was "07L" should be "0L7"

Line 1805: 20th item along was "7XD": should be "HXD".

Chris Lam,
Redhill,
Surrey.

SMALL PRINT

I have a little advice for your readers to do with software adverts, after having been taken for a ride by a software house.

I ordered three games but got back two totally different programs. I sent the packages back two months ago and have only just got my money back, after many phone calls and letters.

My first piece of advice is read the advert thoroughly, especially small print — for example, add 50p for postage and packing and 15 percent. for VAT. Second, always ring the company concerned before ordering the program, making sure the software is still available and not out of circulation. Finally, ask if there is a money-back guarantee.

Mark Wilkinson,
Brighouse,
Yorkshire.

Home doctor needs Vic

EASTMEAD COMPUTER Systems has released six cassettes in a Home Doctor series. Each cassette contains 18 programs which give advice on a variety of symptons and health topics. Diagnosis is given on most complaints. The list of topics leads off with abdominal pains, alcoholism, backache and bad breath.

The content of these programs has been prepared by Dr Vernon Coleman, author of a number of books on home medicine.

The cassettes cost £6.75 each or £33.95 for all six. They are available by mail order for the Vic-20 and ZX-81 from Eastmead Computer Systems Ltd, Eastmead House, Lyon Way, Camberley, Surrey GU16 5E2.

Fast Spectrum 16K compiler

SOFTEK'S COMPILER for the 48K Spectrum enables Basic programs to run up to 10 times faster than normal. In contrast to the standard Basic interpreter which converts Basic to machine code while a program is running, a compiler produces a machine code version of a program prior to run time.

The compiler takes up around 16K at the top of RAM. The present version can cope with about 80 percent of Spectrum Basic commands. Compiled code is not quite as efficient as tailor-made machine code.

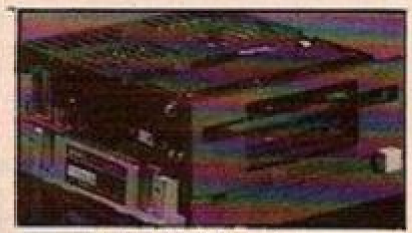
The program is available from Softek, 329 Croxted Road, London SE24.

Microdrives break the £200 price barrier for home mass storage

ALTHOUGH BUDAPEST Radio Engineering invented the micro-cassette disc-drive in 1974 the rest of the computer world stayed with 5in. drives or bigger. Now Sinclair, Sony, and Hitachi are all launching micro-drives in the next few months and BATS-NCI is importing the Hungarian drive.

Sinclair's Microdrive appears next month, and Sony is selling a 3.5in. floppy disc to other computer manufacturers which will have twice the capacity of traditional 5.25in. discs yet costs about £200. Hitachi's 3in. disc system will be even faster but more expensive.

Bill Musker of BATS-NCI discovered the MCD1 micro-cassette drive by chance on a trip to Hungary: "I happened to notice one sitting on someone's desk". He was convinced that the Hungarian drive which takes a 3in. floppy-disc protected by rigid cassette was ideal for low-cost micros.



Now Commodore wants to use the drive for the Vic-20. David Briggs, head of the hardware support division says that Commodore is acting as a catalyst between BRE and BMB Computers who will be developing the system. If tests of the prototypes prove favourable Commodore will market a twin-drive 300K system after Christmas; but Briggs is still cautious: "The Hungarian company is a totally unknown factor in this market."

Meanwhile Premier Publications has already adapted the BATS-MCD1 for use with the Video Genie and UK-101. A Dragon version will be available for less than £200 by the end of the month from Premier Publications. Telephone 01-659-7131.

Painting the Mary Rose made easy with Spectrum digital tracer



DIRECT INPUT of images to screen is no longer a dream since the release of a digital tracer for the Spectrum.

The RD Laboratories Spectrum digitiser consists of an arm which you use to trace the picture you want displayed on screen, and software routines which allow you to change colours or shade in parts of the display on screen or to save the picture as a display file or copy direct to a printer.

At £49.95 the RD Digital Tracer could save hours wasted plotting in individual points or lines to build up complicated pictures. RD's tracer will also work on the ZX-81 although with less spectacular results. Details from RD Laboratories: telephone 0920-84380.

Open sesame for dial-a-game and electronic mail for £60 from Oric

JANUARY'S LAUNCH of the Oric modem will bring telesoftware and electronic mail within the budget of home computer owners. The £60 modem will plug in to Oric's £100 16K microcomputer which was revealed in October's *Your Computer*.

An autodialler for telephones, and Prestel and viewdata facilities can be easily added to the modem. Sinclair had hoped to be first on the market, but his low-cost adaptor for the Spectrum will now not be available till the spring after Oric and Micronet. Oric's Peter Harding says "Sinclair will probably copy ours."

Oric will launch the modem with a free dial-a-game service which will allow users to download a variety of programs at any time of day or night under a name which could be tempting providence. Microcomputing already resembles a pantomime, complete with wicked uncle, without Oric calling this facility Aladdin's Cave.

Peter Harding is enthusiastic about sending programs down the telephone wires. "Telesoftware is going to be the medium of the future for software." The combination of Oric 1 and the modem will convert a television into a receiving station which can display pictures and text sent by any other Oric owner with a phone, for just £160.

Disabled computer enthusiasts now have their own version of the Spectrum. Possum's system allows the handicapped to direct a light scan around an indicator panel by using an expanded keyboard or pneumatic input to select the computer function they require. Details from Possum Controls: telephone 0753-79234.



Micronet offers Prestel for £50

BRITISH TELECOM leads a consortium hoping to draw 100,000 micro users into the Prestel network by offering adaptors for £50 to £100. When it opens on January 1, 1983, Micronet 800 will also provide a 30,000 page database for those micros linked to Prestel through the telephone system. The subscription fee to Micronet will be around £1 a week.

On top of the 200,000 pages of information already on Prestel, the service will include buyer's guides, user-group news, a bulletin board, magazine features and advertising, games and prizes, and an electronic mail facility. But of greater interest to micro users will be the 20,000 pages of downloadable software, some of it free of charge.

At the same time, Prism Microproducts will supply Prestel adaptors for the ZX-81, the Spectrum, BBC, and later the Vic and the Dragon.

Audiogenic is chess Boss

AUDIOGENIC CLAIMS that Boss, a Vic-20 chess game, has triumphed against programs for the Pet, Apple and Texas TI-99/4. Boss requires a minimum of 8K memory and costs £14.99 from Audiogenic, PO Box 88, Reading, or from most Commodore dealers.

Epson's £500 portable could be the shape of things to come

EPSON'S PORTABLE computer, the HX-20, is the shape of things to come. Within a few years portable machines will capture at least 40 percent of the microcomputer market, say the experts.

For less than £500 the HX-20 includes a built-in printer, an LCD screen and a full-size typewriter keyboard, but weighs under four pounds. The use of CMOS circuitry allows 50 hours battery operation from built-in NiCad batteries which can be recharged overnight. Programs and data can be retained in RAM when the power is switched off.



The liquid-crystal display gives four lines of 20 characters or 120 by 32 dot graphics. It can act as a window on a larger screen 255 characters wide. Like the Amber 2400, which has the same Epson mechanism, the dot-matrix printer uses an inked ribbon to give 24 columns on plain paper.

The 32K ROM containing the operating system and Microsoft Basic can be expanded to 64K, while another 16K RAM can be added to the 16K present on board. The compartment to the right of the screen can take a micro-cassette drive or ROM and RAM cartridges.

RS-232C and serial interfaces provide for connections to a Modem, disc drive and larger printers. Other features include a clock-calendar with an alarm and a four-octave sound generator.

BBC smashes the system

MOST BBC MICROS to date have been supplied with the 0.1 operating system which cannot support disc drives. Among its other shortcomings is a bug which causes occasional problems in saving to tape and the inability of the RS-423 port to receive data. Now Acorn is supplying the new 1.2 ROM free of charge to owners with the 0.1 system in EPROM and also to people who buy peripherals which require the new ROM. Owners with the 0.1 system in ROM will have to pay a replacement fee of £10.

Disc drives for the BBC also need a disc interface. This will cost £70 plus up to £15 fee for fitting. Acorn's BBC disc drive costs £264 and has a capacity of 100K. A rather cheaper 163K Control Data drive is available from Microware, 637 Holloway Road, London N19. Telephone 01-272-6398.



Sord reveals £100 4K colour micro

NOW SORD, one of Japan's biggest computer manufacturers, is joining the battle for Britain's home micro market. Sord describes the £100 M5 as a "variety computer" which is supposed to be capable of anything from "playing intellectual games" to "data processing". Software will be supplied on cassettes and cartridges.

The all-singing, all-dancing machine will have 4K user RAM plus 16K video RAM, and 8K ROM with built-in monitor, with full colour graphics including 32 types of sprites. The Z-80A based M5 is about the same size as an Atom with a Spectrum-style keyboard. It should start appearing in Britain from January.

Plug-in cartridges for the M5 will include PIPS, a home version of the management package which has helped Sord to 20 percent of the Japanese market.

Manchester stages bigger and better Northern Computer Fair

FOLLOWING THE SUCCESS of our Earls Court show in April *Your Computer* has organised the Northern Computer Fair to be held at Belle Vue, Manchester on November 25-27. Over 38,000 people, mainly from London and the Home Counties, visited Earls Court.

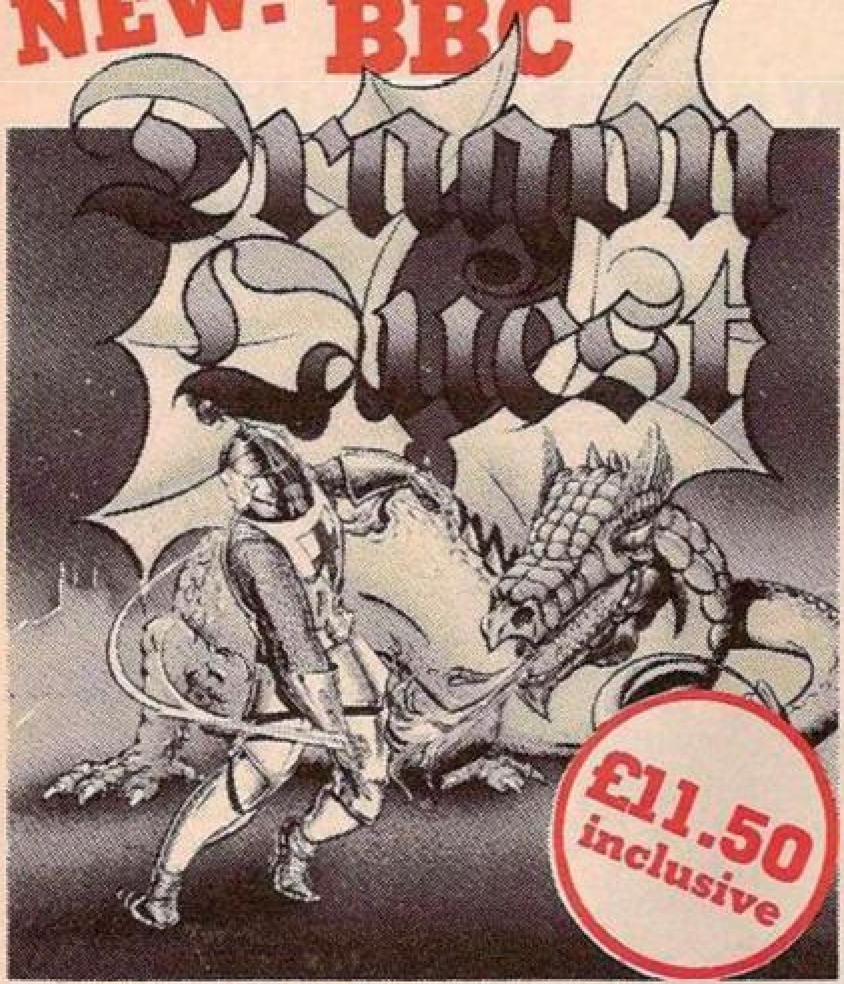
The Belle Vue show will give northern readers an opportunity to try out the products of more than 80 computer companies. The Sinclair Village is already fully booked and it will be even larger than at Earls Court. The latest in machines and software will be on show.



Like a camel the Memic-81 goes a long way without refuelling. It allows you to store a program for up to 10 years and access it almost instantly. It uses a CMOS memory chip and 10-year life Lithium batteries. Loading a program requires a couple of Pokes and a USR call. A 2K version is priced at £28.70, and the 4K version costs £34.45 from Cambridge Microelectronics, 1 Milton Road, Cambridge CB4 1UY.

ZX81... SPECTRUM... BBC MICRO... COLOUR GENIE... ATOM... VIC

NEW! BBC



an exciting adventure game based on 'Dungeons & Dragons' includes graphics and text.

also for your BBC Micro

CHESS



The very first, powerful and exciting chess game for the BBC Micro. One thousand levels of play, plus many options including setting up board for chess problems, saving games on tape etc. Deals with castling and en passant.

SPACEWARP	£9.00
SPACE PIRATES	£5.50
POLARIS	£8.00
MULTIFILE	£25.00
BACKGAMMON	£8.00
GOLF	£5.50
AIRLIFT	£5.50
FRUIT MACHINE	£5.50

SPECTRES



... more mystery and excitement on your Spectrum as Eddy the electrician tries to thwart the ghosts in the mansion with his secret light generator. (from the developers of 'Spectral Invaders').

SPECTRAL INVADERS–£5.00

also for your BBC Micro (32K)

SPACEWARP



VIC



VIC Chess
Another VIC in the wall
VIC Gammon
VIC Panic
VIC Cosmiads
VIC Asteriods

All prices include postage.

COLOUR GENIE programs coming soon!

ORDER YOURS TODAY!

BUG-BYTE SOFTWARE

Please send me ________
I enclose cheque/P.O. for ________
OR Please debit my Access 5224 ________
BARCLAYCARD 4929 ________ Expiry date ________
Send s.a.e. for Free Bug-Byte Catalogue.
Name ________
Address ________
________ Code ________
Dealers Discount Available
ACCESS, BARCLAYCARD ORDERS WELCOME ON 24 hr. ANSAPHONE 051-227 2642, or mail to:
BUG-BYTE SOFTWARE, FREEPOST (No stamp req.) LIVERPOOL L3 3AB.
YC.11.82
BARCLAYCARD VISA
Access

BUG-BYTE SOFTWARE, FREEPOST (No Stamp req.) LIVERPOOL L3 3AB.

ZX81... SPECTRUM... BBC MICRO... COLOUR GENIE... ATOM... VIC

COMPUTER CLUB

Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.

Southampton rings the changes

Each month in Southampton the Southern Gas Computer Club meets in the Corporation HQ. Many members are professional programmers but Paul Bond finds they share many of the obsessions of the home hobbyist — from Pac-man to computer art.



IT IS REWARDING to discover that we keep local user groups abreast of developments even on their own doorsteps. This month's lecture on new micros included — thanks to our October issue — the MPF-II, which is marketed by a Southampton company. Members hope that the machine will shortly be demonstrated to them.

Derek Cambray, who gave the talk, is systems programming controller for Southern Gas — so he is equally at home with an IBM-3032 mainframe or a ZX-81. This might lead one to conclude that the club has some very highly-qualified members, but it would be wrong to assume their activities are mind-bogglingly esoteric. Although the core of the club was formed about six months ago in Southern Gas's Data Processing Department, the members stress the club is very much for the enthusiastic amateur, as well as providing light relief for those accustomed to dealing in megabytes. Membership has grown steadily to include those outside the DP section, and younger users were much in evidence during our visit.

The club itself is smiled upon by the higher echelons of Southern Gas management, who are keen to encourage computer literacy. There is no stinting on facilities. Not only are excellent coffee and sandwiches provided free of charge as well as two rooms, but there is full access to all the audio-visual equipment belonging to the corporation's publicity and training departments. This means excellent quality monitors, guaranteed to turn the more impecunious computernik red, green and blue with envy, are available at every meeting.

Members are also allowed to use the company Pets — an 80-column machine with disc drive was running a script Adventure game with all the unexpected replies and jokes that around 96K can handle. Hardware was varied: two Pets, two BBC Model As, one Acorn Atom and a Spectrum, which produced impressive effects on a gargantuan Sony monitor. On the minus side, an unfortunate ZX-81 owner spent much of the evening failing to load his chess game.

One of the committee members, Andrew Craddock, had an unusual application for his Acorn Atom. A bell-ringing enthusiast, he has developed a program which, via a specially-built synthesiser peripheral, produces soothing xylophonic sounds. Since all bell-ringing is based on different permutations of eight numbers, the Acorn's job is to stand in for the seven other rope-pullers — the player provides the eighth note, according to which style one is playing in. The styles are named after counties like Yorkshire, Lincolnshire and Rutland. Computerised campanology, no less.

Ian Smith, another committee member, produces the club's newsletter — a daunting task well-executed, with the aid of John Trippick's impressive artwork. He took on the job because he was a member of two other micro clubs and, he says "I couldn't understand either of the newsletters".

Three issues have been produced already and are circulated among a membership of 60. For the future, the club's committee which, apart from Andrew Craddock, Ian Smith and Derek Cambray consists of Charles Dickens, Andy Harker and Dave Walker, plans to set up an extensive software library, and to continue their successful series of lectures on individual types of machine. If you want to find out more, contact Andrew Craddock on Southampton 824496. ■

Local society news

Computers in the Chilterns

THE RECENTLY-FORMED Chiltern Computer Club caters for enthusiasts from the Dunstable and Leighton Buzzard areas. Their meetings are held in the function room of the Five Bells pub in Eaton Bray at 7.30 on the second and fourth Mondays of each month. Telephone Stephen Betts on 0525-220922 for details.

BBCs in Preston

PRESTON AREA BBC Microcomputer User Group is starting a software library and a regular newsletter. The library will be run on a points system, with one point allocated per pound of purchase price. Members' programs will be evaluated by the club. Meetings take place at Preston Polytechnic in Room F2. For details, contact D Coulter, 8 Briar Grove, Ingol, Preston, Lancashire PR2 3UR.

Dublin micros

THE IRISH Amateur Computer Club, recently formed, wish to hear from anyone interested in personal computing in the Dublin area and other parts of Ireland. Contact Martin Stapleton, 48 Seacourt, Clontarf Dublin 3. Telephone 331304 or send stamped, addressed envelope to Brendan Haligan, 22 Gormore Avenue, Finglas South, Dublin 11.

Hampshire amateurs

THE FAREHAM and Portchester Amateur Computer Club have recently organised a referral service and users' group for the BBC Micro. The group meets at 7.00pm on the third Monday of each month at the Portchester Community Centre. Contact: Peter Smith, 23 Sandy Close, Petersfield, Hampshire. Telephone: 0730-4059, evenings.


ORIC-1
ORIC-1™
TIMELESS TECHNOLOGY FROM ORIC PRODUCTS INTERNATIONAL

The Computer Challenge

16 colours professional keyboard full graphics real sound

- Superb styling
- Choice of 16K RAM or massive 48K RAM
- Ergonomic keyboard with 57 moving keys
- 28 rows x 40 characters high resolution
- Teletext/viewdata compatable graphics
- 6 octaves of real sound plus Hi-Fi output
- Centronics printer interface and cassette port
- Comprehensive user manual

THE REAL COMPUTER SYSTEM FOR £99.95 incl VAT

OPTIONAL MODEM OFFERS COMPUTER PHONE LINK FOR:
● ELECTRONIC MAIL ● TELESOFTWARE ● PRESTEL

COMING SOON, TO COMPLETE YOUR SYSTEM: ORIC MICRO-DRIVE DISCS & SPEED PRINTER

FOR HOME: The ORIC-1 is the professional alternative for home computing. Superbly styled, the 57 key layout is based upon computers costing many times more than the ORIC, and will help the whole family to learn and understand computing, right from day one. The ORIC incorporates an improved version of Microsoft Basic for ease of programming and use. For the enthusiasts the computer has laser zaps, explosions, etc. pre-programmed for games use, with Hi-Fi output for incredible effect. The communications Modem will allow 'Telesoftware', message sending, and Prestel use.

FOR BUSINESS: The ORIC-1 is the answer to many day to day problems. Software is becoming available for payroll, accounts, stock-control, and many more systems to help your day to day business organising and control. In addition, the ORIC COMMUNICATIONS MODEM will allow you to access up to 200,000 pages of Prestel information, to send and receive 'electronic mail', to book hotels, and flights (and pay for them) and to look at the latest stock-market and share indexes.

In short the ORIC-1 is a must for all businesses large or small.

HOW TO ORDER YOUR ORIC-1: By phone: Just ring our telesales number Ascot (0990) 27641.

By post: You can pay by cheque, postal order ACCESS – BARCLAYCARD – AMEX – DINERS. (Please allow 28 days for delivery). Money back if not satisfied.

ORIC-1
The Real Computer System

ORIC PRODUCTS INTERNATIONAL LTD Coworth Park Mansion, Coworth Park, London Road, Sunninghill, Ascot, Berks SL5 7SE

Item	Qty	Price Inc VAT	Total
ORIC-1 16K RAM		£ 99.95	
ORIC-1 48K RAM		£169.95	
ORIC Communications Modem		£ 79	
Postage and Packing			£ 5.95
		TOTAL £	

*Please delete/complete as applicable.
*I enclose a cheque/P.O. payable to: ORIC PRODUCTS INTERNATIONAL LIMITED for £ ____

Please charge my Access, Barclaycard Amex, Diners Club account no.

Name

Address

If you require a brochure please tick ☐

CT

Today's micros offer tremendous opportunities for colour graphics. You do not need to be Salvador Dali to conjure up surreal shapes in unnaturally bright colour any more. Tim Langdell illustrates graphics for the beginner, from simple shapes to 3D rotations.



HIGH-RESOLUTION Drawing and Plotting is a feature of the BBC Model B, the Dragon 32 and the ZX Spectrum. Although the BBC machine has finer definition both the Dragon and the Spectrum have such built-in facilities as circle drawing.

Simple plotting

The Spectrum is the easiest to use for simple Plotting to the screen. You simply envisage the screen as a matrix of dots 256 wide by 176 high and use a straightforward Plot X,Y statement to place a dot in the required position. Adding Over 1 to the statement removes the dot:

PLOT OVER 1; X,Y

On both the BBC and the Dragon you must first choose your mode of resolution. The BBC offers a choice between a 256 by 16 graphics screen, 256 by 320, or 256 by 640.

Once the level of resolution is set, you can use Move and Plot to place dots, or pixels, on the screen. Move has the form Move X,Y and moves the graphics cursor to the position X,Y on the screen without drawing anything. Plot draws using the following, very simple form:

PLOT X,Y,K.

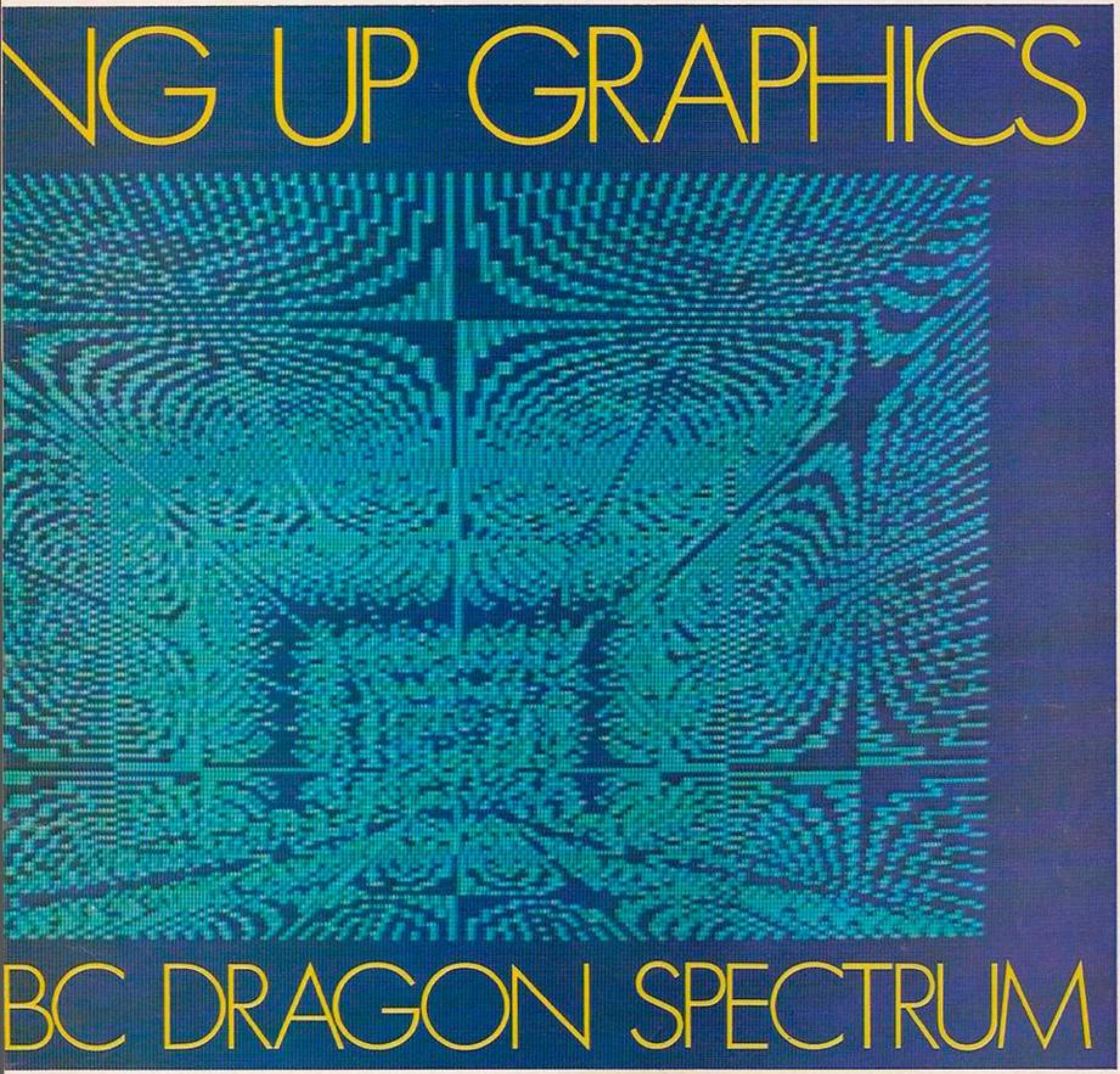
X and Y are the co-ordinates again, but K can take one of the following values:

0 Move relative to last point.
1 Draw line relative in current foreground — INK — colour.
2 Draw line relative in logical inverse colour.
3 Draw line relative in current background — PAPER — colour.
4 Move to absolute position — same as using Move.
5 Draw line absolute in current foreground colour
6 Draw line absolute in logical inverse colour.
7 Draw line absolute in current background colour.

Moreover K can have higher values: 16 to 23 draw the lines as dotted, and 80 to 87 draw filled triangles. The BBC has many more of these facilities than the Spectrum.

The Plot command is also used to draw lines on the BBC, whereas a separate Draw command is used on the Spectrum. This allows you to draw between two points defined by the last position Plotted and the co-





ordinates of another point given after the Draw keyword:

DRAW 128,88

The Dragon does not use Plot, but rather Set and Pset depending upon which mode of resolution you have chosen. In low resolution Set is used and in higher resolution Pset is used. Both Set and Pset have similar forms: Set (X,Y,C) and Pset (X,Y,C). The two co-ordinates of the point to be plotted are inside the brackets followed by a code number for the colour of the dot. In BBC Basic this colour is set with a GCol command just prior to the Plotting, whereas in Spectrum Basic one can either set the Ink colour globally or within the Plot statement itself, so that the colour is only that of the dot:

PLOT INK 2: 128,34

Drawing lines on the Dragon is done using Line, in the following form:

LINE (100,100) — (130,135),PSET

The co-ordinates of the line's starting point are put inside the first brackets. The ending point is put in the second brackets. The statement must then be terminated with PSet.

The Dragon can also draw a box with these co-ordinates by simply adding a B after the PSet. Adding BF, moreover, creates a filled box at those co-ordinates.

More complex statement

The Dragon also has Draw, but this refers to a more complex Basic statement. Using Draw on the Dragon you can create a whole series of dots and lines held within a string. The following aspects may be included in a Draw expression:

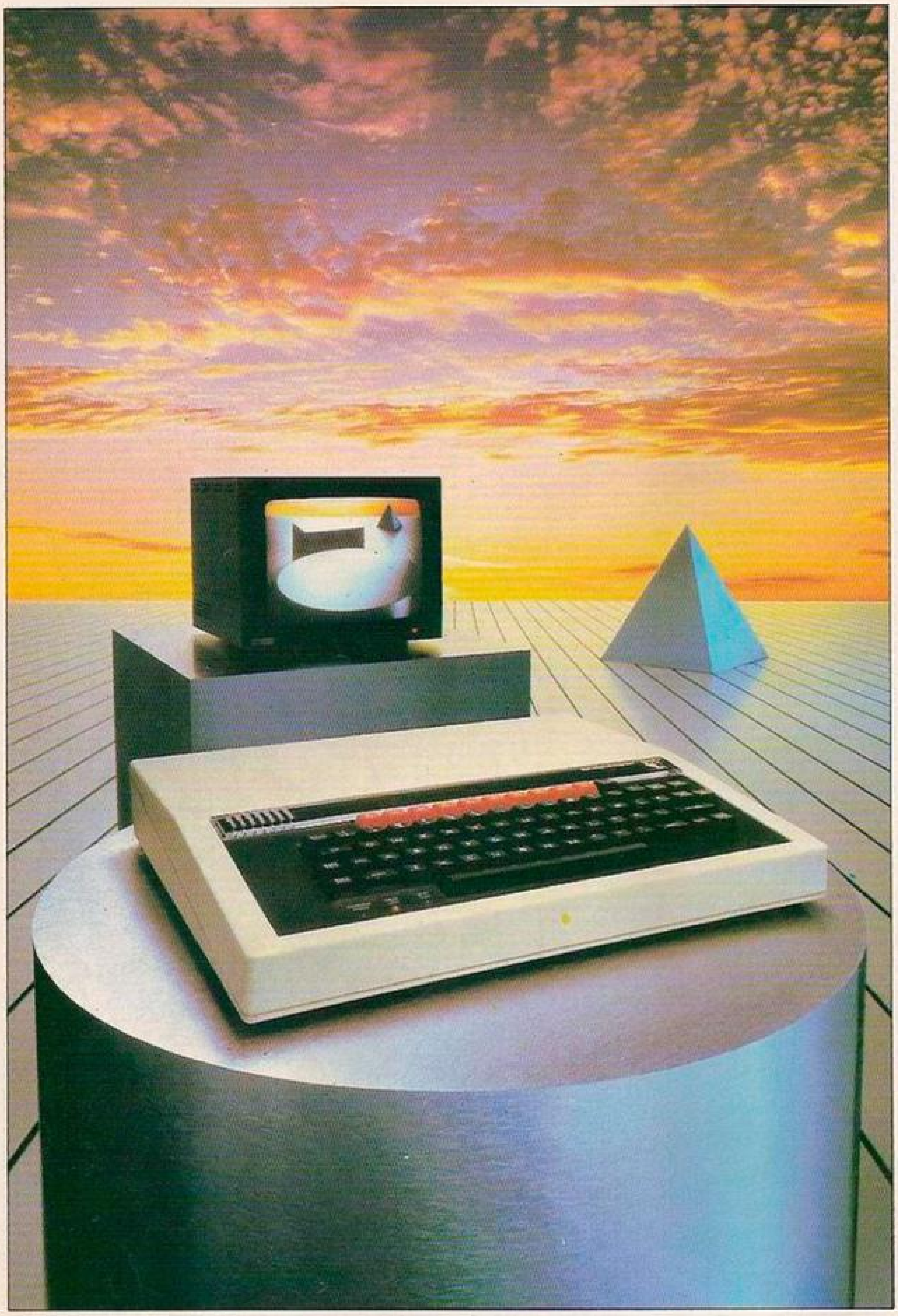
M = Move the draw position
U = Up
D = Down
L = Left
R = Right
E = 45° angle
F = 135° angle
G = 225° angle
H = 315° angle
X = Execute as substring and return
C = Colour
A = Angle
S = Scale
N = No update of Draw position
B = Blank — no Draw, just Move

In many ways this range of options is similar to the range of values of K on the BBC machine, plus the ability to define Drawing at angles to current positions, and scaling a graphic up or down. A Draw string might be:

```
10 DRAW "BM128,96; E25; F25; G25; H25"
```

This draws a square standing on one of its corners.

(continued on page 25)



'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel.'

You can connect directly* to cassette recorder, domestic television, video monitor, disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form, send stamped addressed envelope to P.O. Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

Broader horizons

The BBC Microcomputer System

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research.

The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

(continued from page 23)

Both the Dragon and the Spectrum can draw circles with a single command; the BBC cannot. For the Spectrum, a simple Circle X,Y,R is needed, where X and Y are the co-ordinates of the circle's centre and R is its radius. The Dragon's statement is a little more complex because it makes allowance for drawing ovals and only parts of circles. It has the form

```
CIRCLE (X,Y),R,C,HW,S,E
```

where X and Y are the centre's co-ordinates again, R is the radius, C is the code of the colour to be used, HW specifies the height/width ratio, S specifies the starting point of the circle, and lastly E specifies the end point of the circle.

The Spectrum attains partial circles and arcs by using its Draw command in this manner:

```
DRAW X,Y,PI
```

This would draw a semi-circle. Spectrum owners might like to try this brief program by Andrew Glaister:

```
PLOT 55,27: DRAW OVER 1; 120,120,59↑ 3*PI
```

This single line actually produces quite amazing results which are peculiar to Spectrum Basic's Over and Circle drawing facilities. Over, on the Spectrum, operates exclusive Or printing to the screen, and this is also available on the BBC machine.

The Dragon 32 is the only machine of the three with a Paint command. This works by simply stating the starting point of the Painting process, the colour of the Paint and the colour of the line where the Painting should end.

For those with a Dragon, program D1 uses both the Paint and Get/Put features.

Get and Put are Dragon commands which can come in very useful for fast-moving games and animation. They Get an area of the screen within a box, defined by co-ordinates X and Y, and Store the points which make up that box in an array.

This array can then be put back anywhere else on the screen. The BBC machine has such fast Basic that it can attain similar results by simply Plotting or Printing user-defined characters on the screen.

The Spectrum however, has neither the Get/Put facility, nor the speed of the BBC machine. In trying to speed up graphics in games it is worth trying to put the characters into a string on the Spectrum, and then Printing the string at progressive positions on the screen.

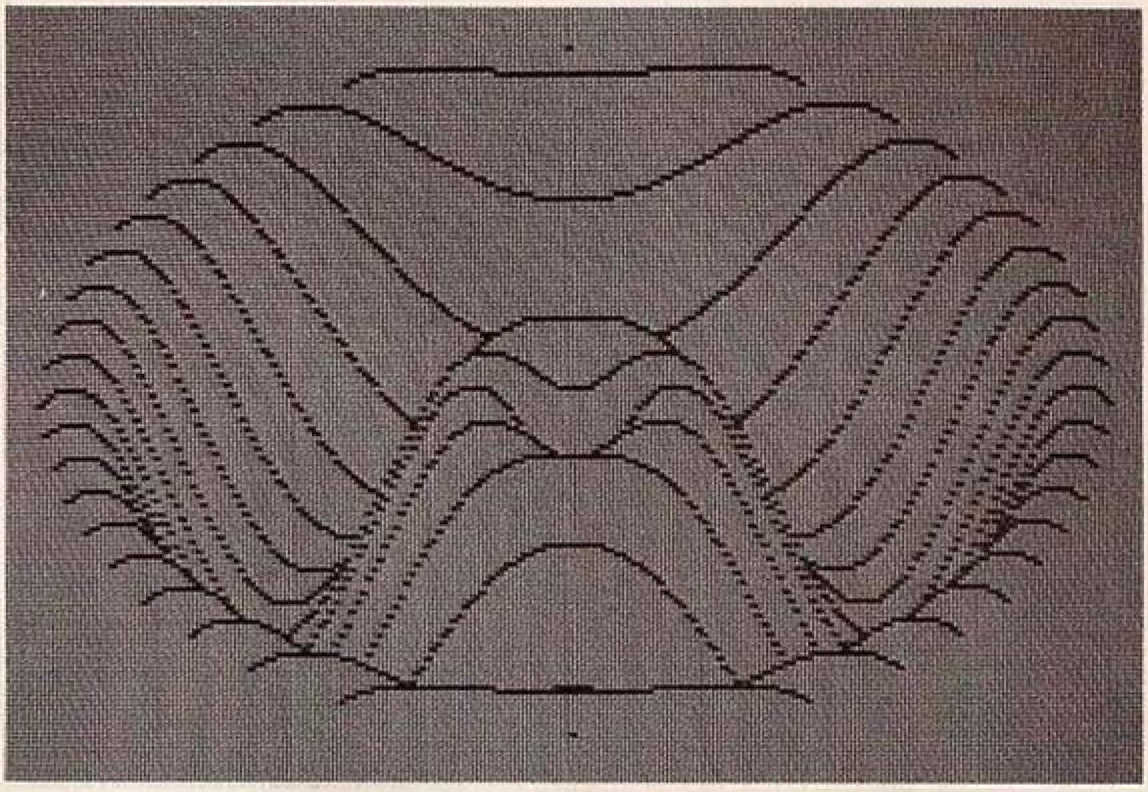
The alternative on the Spectrum is the Poke to the screen, but this can be difficult due to the way the screen is mapped.

The first byte of each character position on the first eight rows is Poked first, followed by the second byte, and so on until the characters in the first eight rows are complete. Then the next eight rows are done in the same way, and finally the bottom eight rows.

The Dragon can perform fairly smooth graphics using its Get and Put instructions. Here, for instance, is a program which Gets a circle in the upper left-hand corner of the screen and Puts it at intervals across the screen, clearing the screen between each Put. The fairly smooth motion of the Dragon is illustrated in program D2.

The Spectrum is slower than the other machines, and short of machine code you will have to resort to tricks to portray moving graphics.

For instance, if you have two objects moving on the screen at the same time — a laser beam or bullet speeding toward a spacecraft for instance, then you would be advised to determine the speed of the spacecraft — when no firing is occurring — by the length of an overall delay loop. When the laser is fired, the delay loop slowing down the craft should be decreased and the travel of the laser arranged to take its place.



SPECTRUM

Program S1.

```
  5 DIM X(4) : DIM Y(4)
 10 PLOT 128,88
 20 FOR A=1 TO 4: READ X(A): NEXT A
 30 FOR A=1 TO 4: READ Y(A): NEXT A
 40 DATA 20,20,-20,-20
 50 DATA 20,0,-20,0
 60 FOR A=1 TO 4
 70 DRAW X(A),Y(A)
 80 NEXT A
 90 DIM H(4): DIM V(4)
100 FOR B=3 TO 50 STEP 5
110 PLOT 50 +B,88
120 FOR A=1 TO 4
130 LET H(A)=X(A)*COS (PI/B)-Y(A)
    *SIN(PI/B)
140 LET V(A)=Y(A)*SIN(PI/B)+X(A)
    *COS(PI/B)
150 NEXT A
160 FOR A=1 TO 4
170 DRAW H(A),V(A)
180 NEXT A
190 NEXT B
```

Program S2.

```
  5 OVER 1
 10 PAPER 5: INK1: BORDER1: CLS
 20 LET X1=RND*255
 30 LET Y1=RND*175
 40 FOR X=0 TO 255 STEP 0.8
 50 PLOT X1,Y1: DRAW X-X1,-Y1
 60 PLOT X1,Y1: DRAW X-X1, 175 -Y1
 70 NEXT X
 80 FOR Y=0 TO 175 STEP 0.8
 90 PLOT X1,Y1: DRAW -X1, Y-Y1
100 PLOT X1,Y1: DRAW 255-X1,Y-Y1
110 NEXT Y
```

Craft and laser

Thus the movements of the craft and laser would interchange rather than having the craft stop every time the laser fires. Even this method, though, cannot allow you to create very complex moving games on your Spectrum, although you can Poke to the screen.

First define the eight bytes which make up the character you are displaying, say, an alien created with user-definable graphics. Then Poke the first byte into the first location of the display file, 16384, followed by the next byte Poked to the location 32*8 bytes further on, and so on through all eight bytes. Then Poke these locations with zero to wipe the character off, and go on to Poke the same eight bytes into locations 16385, 16385+(32*8), and so on. You will find that this allows you to create faster-moving graphics, although your character will appear to scroll into and out of existence.

Holding the graphics information in arrays can also be recommended for the Spectrum. Using control characters in such strings allows creation of very complex figures which would otherwise take several lines of Basic.

The Dragon lets you add either S or R to a Draw statement in order to scale the drawing up or down, or Rotate it about a given angle. You can imagine how useful this is if you want

(continued on next page)

(continued from previous page)

a plane to bank toward you and grow in size as it does so.

Neither the BBC nor the Spectrum has these facilities but simulating rotation is not too difficult. It involves the realisation that, given any set of co-ordinates, X and Y the new coordinates will be:

New X = Old X *COS a − Y(old) *SIN a
New Y = Old Y *SIN a + X(old) *COS a

where a is the angle you are turning the shape through. Program S1 is an example written in Spectrum Basic but easily translatable to the BBC machine.

Rotating shapes

This draws a parallelogram in the centre of the screen, then draws various rotations of the shape on the left-hand side. Unfortunately, in Basic, this routine is rather slow compared to the Dragon's built-in features, and not much use in games involving motion of any appreciable speed.

The simplest way to produce impressive graphics on the machines is to use some quirk of the way the machines does something. The one-line program for the Spectrum is a very good example of this. Another is the moiré kind of pattern that one can quite easily obtain on any of the three machines using their line-drawing facilities. Program S2 is a version for the Spectrum. A multi-coloured version of this can easily be created by adding Inks to the Draw statements.

Three-dimensional graphics are possible quite easily on each of the computers. An example for the Spectrum is shown in figure 1 but almost an identical program could be written for the other machines.

You can try Plotting different functions by changing line 60. In this example the function is:

FN A(T) = 30*SIN T/12,
where T = SQR (X*X + Y*Y)

You can also vary the resolution of the Plot by changing the value of R in line 30. This can be anywhere between about 2 and 10. With R = 10 the Plot will take about 15 minutes, but at resolution 2 it can take several hours.

Figure 1. Spectrum three-dimensional graphics.

```
  5 REM 3-D
 10 BORDER 1
 20 FOR X=-100 TO 100
 30 LET R=10: LET J=0: LET K=1
 40 LET V=R*INT (SQR ((10*4) -X*X)/R)
 50 FOR Y=V TO -V STEP -R
 60 LET Z=INT (80+30*SIN ((SQR
    (X*X+Y*Y))/12) -.7*Y)
 70 IF Z<J THEN GOTO 110
 80 LET J=Z
 90 PLOT X+110,Z-15
100 LET K=0
110 NEXT Y: NEXT X
```

Figure 2. Rotating ball for BBC.

```
ROTATING BALL:
 10 MODE 1
 20 PROCBALL (110,640,572,1)
 30 REM CHANGE ALL COLOURS TO
    BLUE
 40 FOR X= 1 TO 3
 50 VDU 19,X,4;0;
 60 NEXT
 70 A= INKEY (10)
 80 REM ROTATE BALL
 90 FOR X= 1 TO 3
100 VDU 19,X,7;0;
110 S=INKEY (10)
120 VDU 19,X,4;0;
130 NEXT
140 GOTO 90
150 DEFPROCBALL (S%,X%,Y%,C%)
160 VDU 29,X%;Y%;
170 MOVE 0,S%
180 FOR A=0 TO 20*PI STEP 0.2
190 SA=SIN(A)
200 Q%=1+(1+A/(PI*2))MOD 3
210 GCOL 0,Q%
220 IF SA<0 THEN GCOL 0,4-Q%
230 X%=S%*SA*COS(A/40)
240 PLOT 85,X%,S%*COS(A)
250 PLOT 85,X%,0
260 NEXT
270 ENDPROC
```

Figure 3. Fireworks for BBC.

```
FIREWORKS:
 10 MODE 2
 20 FOR G%=0 TO 20
 30 GCOL 0, RND(7)
 40 PROCelipse (0,500,120+RND(30),
    600+RND(200),
    SGN(RND)*(RND(100)),2)
 50 NEXTG%
 60 FOR G%=0 TO 20
 70 GCOL 0, RND(7)
 80 PROCelipse (0,750,120+RND(30),200+
    RND(50),SGN(RND)*(RND(150)),7)
 90 NEXTG%
100 GOTO160
110 DEF PROCelipse (X%,Y%,L%,
    XR%,YR%,S%)
120 FOR T%=0 TO L% STEP S%
130 PLOT 69,100+ SIN(RAD(T%))
    *XR%+X%,COS(RAD(T%))
    *YR%+(Y%-YR%)
140 NEXTT%
150 ENDPROC
160 FOR A%=900 TO 1000
170 GCOL 0,7
180 D=400+RND(1000)
190 PLOT 69,D,RND (1500)
200 NEXT
210 FOR A=1 TO 1000
220 GCOL 0,2
230 PLOT 69,100*SINA,A
240 NEXT
```

The Dragon Draws rather spiky-looking circles in one of its modes, but even this can be used to advantage. Program D3 makes a kind of lace pattern. A rather nice spiral cobweb is created by D4.

The BBC machine has a unique facility in that by drawing a series of curves or lines in a variety of colours and changing each of them, in turn, into one other colour, an impression of movement can be given.

DRAGON

BBC

Combining two ideas in the creative graphics package for the BBC by John Cownie it is possible to create a ball which appears to spin in mid-air. See figure 2.

In fact, the three colours involved have all been designated as blue, and then selected colours redesignated as white, and back to blue again, in sequence, to give the appearance of movement.

Finally, this month's cover was drawn on the BBC. Essentially several partial elipses were drawn turning left or right equally frequently, see figure 3.

Line 40 contains all the parameters which are passed to the procedure for the large spray and line 80 passes the necessary data for the smaller spray. Lines 30 and 70, by the way, create the random colours involved. ■

Program D1.

```
 10 PCLEAR 4
 20 DIM X (25,25)
 30 PMODE 3,1
 40 PCLS
 50 SCREEN 1,1
 60 CIRCLE (128,90),25
 70 PAINT (129,91),2,4
 80 PAINT (129,92),3,4
 90 GET (98,85)-(128,105),X,G
100 PCLS
110 FOR Y=1 TO 200 STEP -1
120 PUT (Y,85 -Y/5)-(Y+55,105 -Y/5),
    V,PSET
130 NEXT Y
140 GOTO 140
```

Program D2.

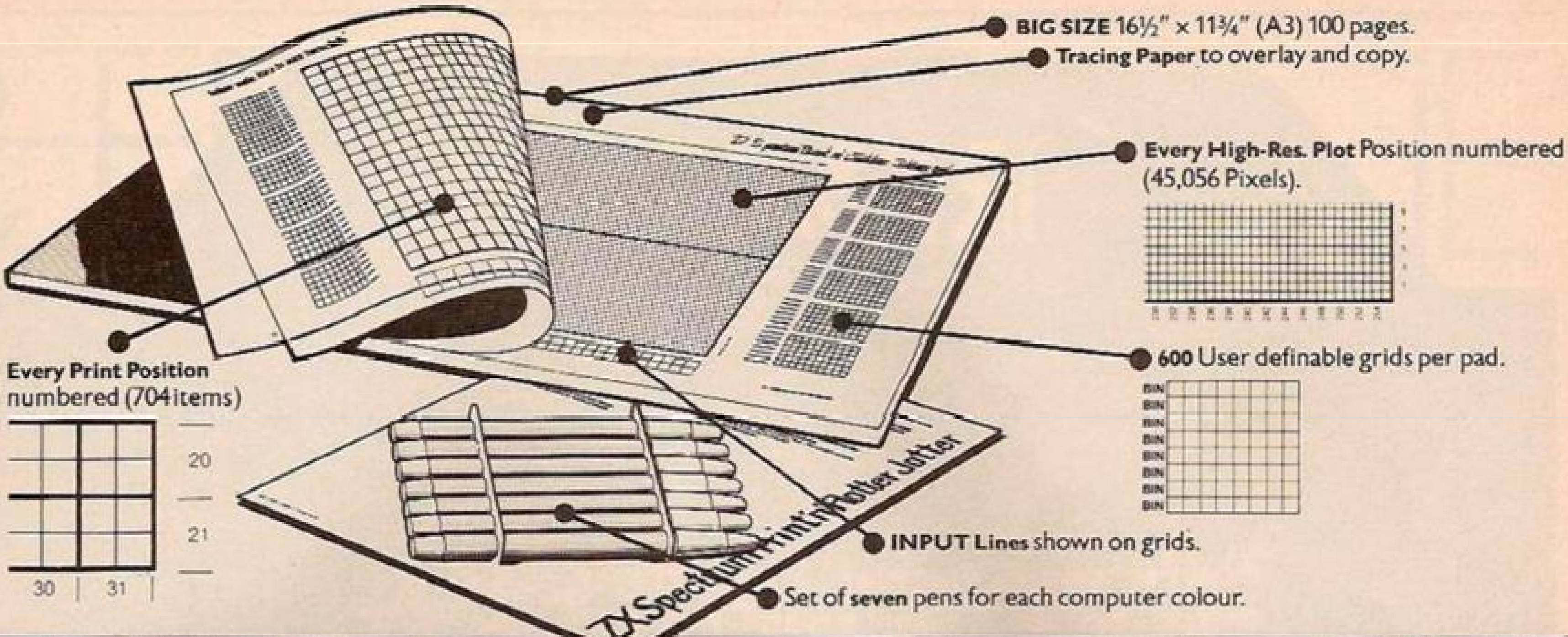
```
 10 PMODE 3,1
 20 PCLS: SCREEN1,1
 30 DIM X(20,20)
 40 CIRCLE (20,20),10
 50 GET (10,10)-(30,30),X
 60 PCLS
 70 FOR A=1 TO 500 : NEXT
 80 FOR Y=10 TO 100
 90 PUT (Y+10, Y+10)-(Y+30, Y+30),X
100 PCLS : NEXT
110 GOTO 110
```

Program D3.

```
 10 PMODE 3,1
 20 PCLS: SCREEN 1,1
 30 FOR X=1 TO 240 STEP 10
 40 FOR Y=1 TO 170 STEP 10
 50 CIRCLE (X,Y),10,,1,.3,.8
 60 NEXT X,Y
 70 GOTO 70
```

Program D4.

```
 10 PMODE4,1;PCLS: SCREEN1,1
 20 X=1.08: Y=50
 30 P=0: Q=10
 40 Q=X*Q: T=P*Y: P=P+2
 50 T=P*Y/60
 60 A=Q*COS(T)+130 : B=Q*SIN(T) +90
 70 LINE -(A,B),PSET
 80 IF A>190 OR A<0 THEN 100
 90 GOTO 40
100 GOTO 100
```



It will improve your ZX SPECTRUM graphics in ways you wouldn't believe possible.

Your new ZX Spectrum is literally packed with sophisticated graphics. Colour. High resolution. Plot. Draw. Circle. Border. Ink. Paper Colours. User-defined characters to name just a few!

That's why we have packed the new Spectrum Print 'n' Plotter Jotter with every facility to exploit your graphics to the full.

After the first few weeks of "playing" with your computer you will want to get down to serious programming and planning in which professional-looking graphics should play a major part.

What better way to work it out than with a Print 'n' Plotter Jotter?

The professional pad

Print 'n' Plotter is not just another programming pad.

Just look at the specifications:

BIG SIZE 16½" × 11¾". 100 Pages — 50 Print Grids and 50 High Resolution Plot Grids.

Printed on high-quality tracing paper, enabling you to overlay the pages for direct co-ordination between PRINT and PLOT or to copy from illustrations, maps, charts, photos etc.

PRINT Grids show all numbered co-ordinates for the 704 screen positions, plus INPUT lines.

PLOT Grids show every numbered co-ordinate for the 45,056 Pixels!

Each pad contains 600 user-definable grids for use with the BIN n, POKE USR "a" function.

And the whole thing is fully bound with fly leaf cover and complete with a set of seven colour pens!

The simple way to get serious

Spectrum Graphics can become very complex, so before you start to program the best way is *to work it out on a Print 'n' Plotter and save all those errors!*

Take for instance the common CIRCLE. With a Jotter you can establish the exact screen location for the centre in seconds, and it will stop you running out of screen because of a too large radius. Working our DRAW is similar: pre-determine DRAW lines and PLOT positions before you start. With a Jotter you can build-up graphics using every facility with a direct co-ordination between each.

For instance, correct PLOT OVER or PRINT OVER positions will be easy with a Jotter.

See the show for just 60p!

To demonstrate the graphic possibilities with the SPECTRUM JOTTER we have produced a cassette-based Demonstration program for only 60p (inc VAT and P&P). Why not send for a copy, or order it together with your JOTTER?

Just part of a range of ZX products

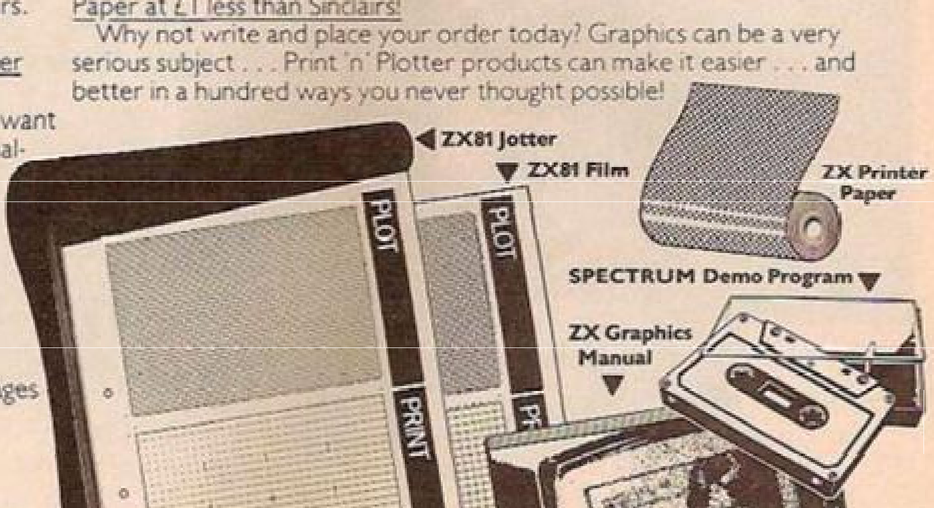
The Spectrum Jotter is, of course, an upgraded version of our popular *ZX81 Print 'n' Plotter Jotter and Film*. For ZX81 owners these are available by direct mail or through a growing number of retailers and compshops.

The ZX81 Jotter is a 100 page Graphics pad that exploits to the full the graphics facilities of that micro. ZX81 Film is a matt film version of the Jotter which is re-usable and ideal for 'copying' graphics.

Our manual: *"ZX Graphics programming made easy"* explains everything you need to know about using the ZX81 products, and when used in conjunction with the Spectrum cassette will prove to be the definitive guide to the subject.

And for ZX users (whether Spectrum or ZX81) we still market Printer Paper at £1 less than Sinclairs!

Why not write and place your order today? Graphics can be a very serious subject . . . Print 'n' Plotter products can make it easier . . . and better in a hundred ways you never thought possible!



An illustrated leaflet is sent with all orders. If you require a copy before ordering write enclosing a first class stamp.

To: Print 'n' Plotter Products (Y), 19 Borough High Street, London SE1

Please forward me the following products:

..... ZX SPECTRUM JOTTERS @ £9.95 each.
..... ZX81 JOTTERS @ £3.50 each.
..... ZX81 PLOTTER FILMS @ £2.25 each.
..... "GRAPHICS PROGRAMMING MADE EASY" MANUALS @ £1.50 ea
..... PACKS OF ZX PRINTER PAPER (5 ROLLS) @ £10.95 per pack.
..... ZX SPECTRUM DEMO CASSETTES @ 60p each.

PLEASE NOTE ALL PRICES INCLUDE POST, PACKING AND VAT FOR U.K. DELIVERIES (Overseas should add 25% for additional Surface Mail)

Remittance enclosed payable to Print'n'Plotter Products.
Please bill my Access/Barclaycard/Visa/Mastercard No:–

Name: ....

Address: ....

Print'n'Plotter Products©

Most Print 'n' Plotter products are available 'over the counter' from the following retailers: • Specialist branches of W.H. Smith • Buffer Micro Shop Streatham • Microware Leicester • Denny's Booksellers London EC2 • Georges Bookshop Bristol • Also represented in U.S.A., Canada and South Africa

REVIEW



Another day, another planet, another micro — but the Ace is so fast that even Bill Bennett had to switch into hyperdrive to review it.

THE JUPITER ACE is a radical departure from the mainstream of microcomputing, and could prove to be the start of a very important new trend. Rather than accepting the prevailing wisdom, Jupiter Cantab designed the machine around the Forth language. In a way, this makes the Ace a breakthrough — it is both the first mass-produced home computer not to use that tired old lady of micro languages, Basic, and is also one of the fastest micros ever made.

The speed element is vital; it is more or less the justification for using a hitherto arcane computer tongue. But speed is not the only advantage of Forth, or indeed of the Ace. It has that all-important feature; structure. Structured programming is definitely the "coming thing". It is preferred by both educationalists and professional programmers alike, and leads me to another fashionable computer buzz-word; portability.

Major differences

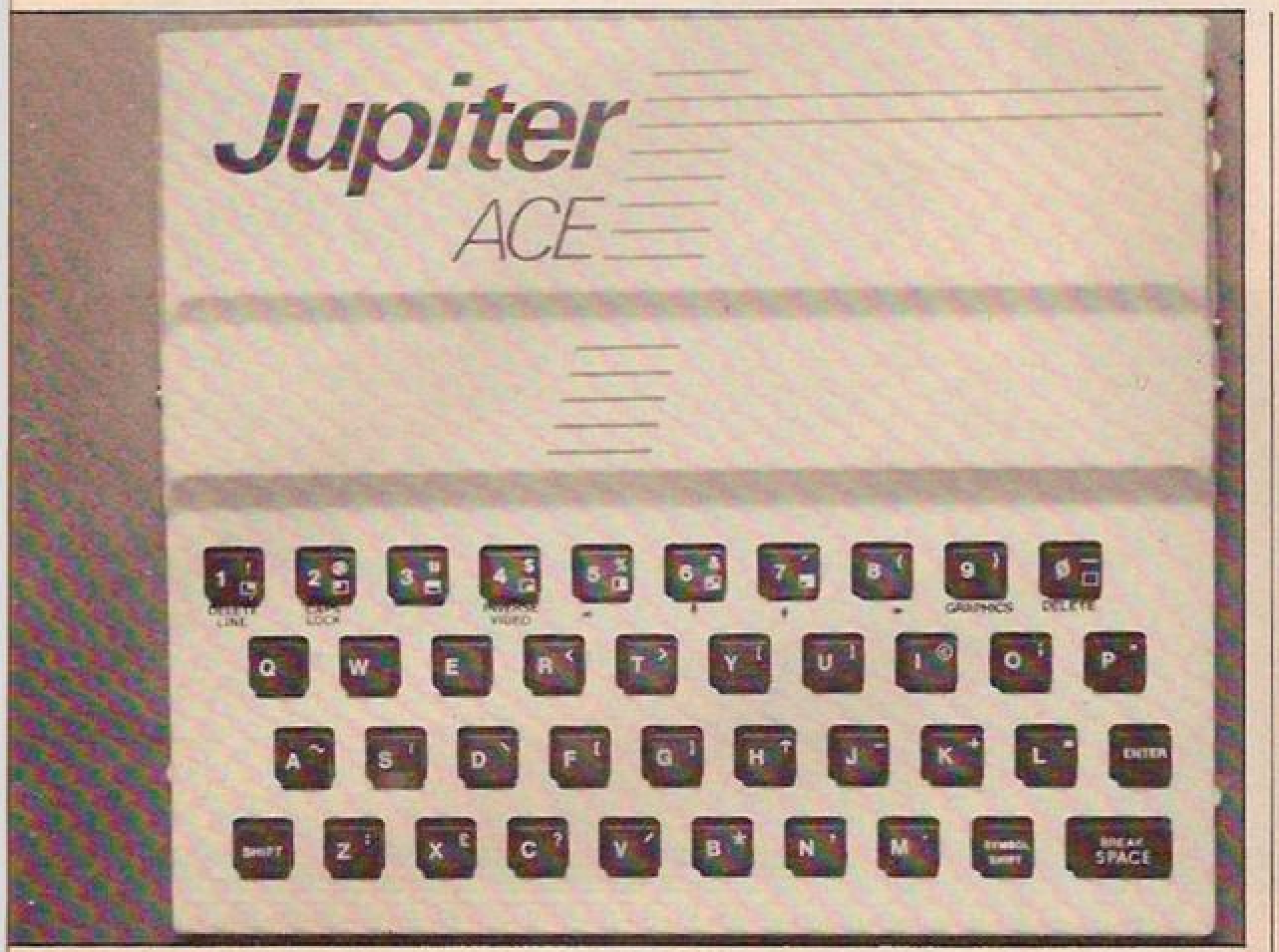
Portability is an important conception in microcomputing. Put simply it means the ability of one computer to run a program written for another, taking the hardware differences into account. Forth is highly portable. Providing the relevant hardware details, such as screen and memory size, are taken into account, any program written in Forth should run on any Forth system.

Programming in Forth is so fundamentally different to programming in Basic that some people prefer not to call Forth software "programs" at all. It is important to discard all your current ideas about programming before you start with the language Forth.

When writing a Basic program, it seems quite normal to think of the control passing through program lines. These lines are like rails along which the control runs, complete with loops and Goto jumps. The control path is often difficult to follow even in your own, short, well-documented programs. Imagine trying to sort out someone else's epic and rather badly-documented program, which they quickly wrote in the middle of the night. This just does not happen with Forth, because each little section of code is debugged as it is written, and the control path does not really exist as a concept.

A Forth system contains a set of words, called a kernel in some implementations. On the Jupiter Ace they are referred to as ROM-words, because they are in the machine's 8K of read-only memory. These words act on whatever number is on the top of the stack,

PEED MACHINE



which is the area of memory that the system plays with.

The best way to think of a stack is as a pile of plates. These plates are the numbers. Plates can be added to the top of the pile at any time, but only the one on the top can be worked on. This is a much more convenient way of managing the memory than using addresses, though with Forth it is still possible to define variables and constants.

Using Forth

Each word in the ROM-word set can be thought of as a call to a machine-code subroutine. Usually any value sent into a subroutine is called a "parameter". In Forth the relevant parameters are those numbers at present on the top of the stack. For example: plus is a Forth word — written + — which adds together the two numbers at the top of the system stack, and then puts the resulting number in their place. Thus, on the Jupiter, when you input

```
2 ENTER the screen shows 2 OK
3 ENTER the screen shows 3 OK
+ ENTER the screen shows + OK
. ENTER the screen shows 5 OK
```

The command "." prints out whatever is currently on the top of the stack. For convenience I will call this "dot". We can think of the numbers 2 and 3 as parameters sent to the plus routine, and the resultant value 5 as the parameter sent to the dot routine.

As soon as a Forth word is entered it is obeyed. A number of words can be entered at a time. For example, our example could have been input as:

```
2 3 + . ENTER
```

The result 5 is printed immediately at the cursor position. It is very important to remember to put a space between all Forth words or numbers as they are entered.

Forth really comes into its own when users start to define their own words. This is very simple to do. New words are formed by combining words already defined, and in some cases using numbers which are placed on the stack. For example, to write a word that will add two numbers together and then print out the result, we shall use the name Plus:

```
: PLUS + . ; ENTER
```

The colon at the beginning indicates that a new word is being defined. What follows it — Plus in this case — is the name of that word. We input the + and . to tell the computer that these are the Forth words which go to make up our word, Plus, and the semi-colon at the end closes the definition.

Once a new word is defined it appears on the top of the vocabulary list. The vocabulary initially contains the 140 ROM-words, and, the top word in the list is Forth. This merely indicates that the words below it constitute the main vocabulary. The Forth word VList makes the machine print out a list of all the words in the vocabulary, including all the new ones.

It is possible to define the same word twice. If, having typed in the word Plus as I described you decided that you wanted to change it so that the screen cleared first, you would have to use the editor. Enter the following:

```
EDIT PLUS,
```

and up comes the previous definition of that word, laid out thus;

```
: PLUS
  + .
;
```

The word CLS — clear screen — would need to be added before the word +. This is done by moving the cursor to the position where the extra word — or words — are to be inserted and typing that word in. The cursor-control keys are the 5,6,7 and 8, used in the same way as on the ZX-81.

Once the word has been changed to the corrected form, typing Enter now places that word in the vocabulary. If at this stage you type VList, you would find that there are two versions of the word Plus in the list. The computer would always execute the second version, leaving the first for dead. This makes debugging software incredibly easy because any incorrectly-defined words can be tested as they are entered and continually hacked about until they reach a correct form.

Because all previous attempts at the same word are kept in the dictionary, you can return to these at any time. When the definitive version of the word has been created, you can save memory space by deleting with Replace all the intermediate attempts.

Unlike most implementations of Forth, the Ace has a substantial level of error-checking. For example, the stack will not overflow. It is also made more powerful by the ability to redefine words without the system crashing.

However, should you require yet more speed than normally available, there is a Fast command. This does away with the error-checking, so it is wise to use it only when a program is totally debugged. It takes the computer's speed up to about 90 percent of a machine-coded program, but it does disable the break key.

At an end-user price of £89.95, the Jupiter Ace is an excellent way of learning an important new computer language. It will have a special appeal to those who feel that they have now grown out of their ZX-81s, especially as far as Basic programming is concerned. It will also be a Godsend to those who want the speed and economy of machine code but cannot grasp its principles.

Fast machine

The Jupiter Ace comes in a white plastic case, not all that dissimilar in style to the now-defunct ZX-80's horrible box. It is undoubtably the machine's worst feature, and the cost-cutting that has been done here could turn out to be that ha'porth of tar that spoilt the ship.

The printing on the case is in a matt-black, broken only by a series of red lines. These red lines are obviously the microcomputer world's equivalent of the "go-faster" stripes that

(continued on page 31)

(continued from page 28)
teenage car owners sport to make their old Ford Cortinas look a little sleeker.

The truth of the matter is that the Jupiter is very fast. The manufacturer claims that it is the fastest microcomputer in this quadrant of the galaxy. This has a lot to do with the rapidity of the Forth language, but some of the credit has to go to the Z-80A processor which nips along at a rate of knots — 3.25MHz to be precise.

Speed implies heat, but there is not much danger of the Jupiter overheating, or at least a sight less danger than some machines, because inside that flimsy plastic case is plenty of breathing room and what is more, the case is better ventilated than that of the ZX range of computers.

Internal design

Sinclair cognoscenti will smile when they peer inside the case and see the heatsink. I often wonder why they are such odd shapes — could it be they were designed by Picasso? Comparisons with the Sinclair machines will inevitably keep cropping up, because the designers of the Ace were, until recently, in the employ of Sinclair Research and so take some of the credit and blame for the ZX Spectrum.

Apart from the gross departure of choosing the Forth language, the design is fairly standard. Sinclair owners will find much inside the Ace's case that is familiar to them.

The keyboard closely resembles that on the ZX-81, both in the number of keys and their layout. But rather than having those horrid little squares that you have to struggle to push down as you program, the Ace uses a rubbery "moving-key" design. Personally I find it is a little like shaking a dead man's hand. The keys do at least have the advantage of being readable — that is, there are none of the Spectrum's red words which you can only track down using special spectacles.

Another small mercy that we can thank Jupiter for — or Zeus if you are Greek — is that there is no single-keyword entry to contend with. However, the designers probably did not abandon it for any good reason, but merely because the infinity of word names available to Forth makes it impracticable.

There are also some significant advances. For example, there are both upper and lower-case letters. It is also possible for the user to define his own character set — in fact by doing so, some reasonably high-resolution graphics are possible. In this way the graphics of the Ace remind me of a non-colour Spectrum. In normal mode there are 32 character positions across the display and 24 down.

In the Plot mode, there is a resolution of 64 by 48 points — not exactly high resolution. If you are prepared to play about with the character definition then this increases to a respectable 192 by 256.

The operation of the word Plot is like the other Forth words. The top three numbers on the stack are the parameters which are passed to a machine-code routine. At the top of the stack is a number which describes how the point is to be drawn, and the next two give its screen location.

Probably the biggest advantage of the Ace's picture quality over the ZX-81's is that the Ace has a rock-steady black screen on which any printing appears in white: the ZX-81 does the reverse which is not a natural way for a computer to behave.

The two machines certainly have a good deal in common, apart from the designer. The review machine did not have a power supply. That was no problem because I used the Sinclair Research one, which worked perfectly.

The user port on the rear of the Ace, closely resembles that on the Sinclair machines. It is not difficult to justify this as there are not really many ways of presenting the Z-80 lines at the edge of a board. Any device that connects to the rear of a Sinclair computer will snugly fit on the back of the Ace. All that is needed is a special cable that unshuffles the lines.

It will probably take a few months at least for a budding Forth programmer to need more than the 3K of user RAM that comes as standard with the Ace, but should you ever require more, the Sinclair 16K RAM pack will fit the bill.

Forth was originally designed as a control language, and the Jupiter Ace makes a fine control computer. In fact, this may become its eventual role. There are two words, In and Out for controlling the data lines. Put the Ace together with any of the available add-on hardware designed for the Sinclair, and you have a powerful control system.

The way forward

Other features available on the Ace include a speaker, which can operate right across the audio range. But, like the Spectum's, it is very quiet. It is controlled by the ROM-word Beep, and can be manipulated very easily by the language. Again, Forth is ideal for this kind of programming, and musical sequences are among the easiest things to write on the Ace.

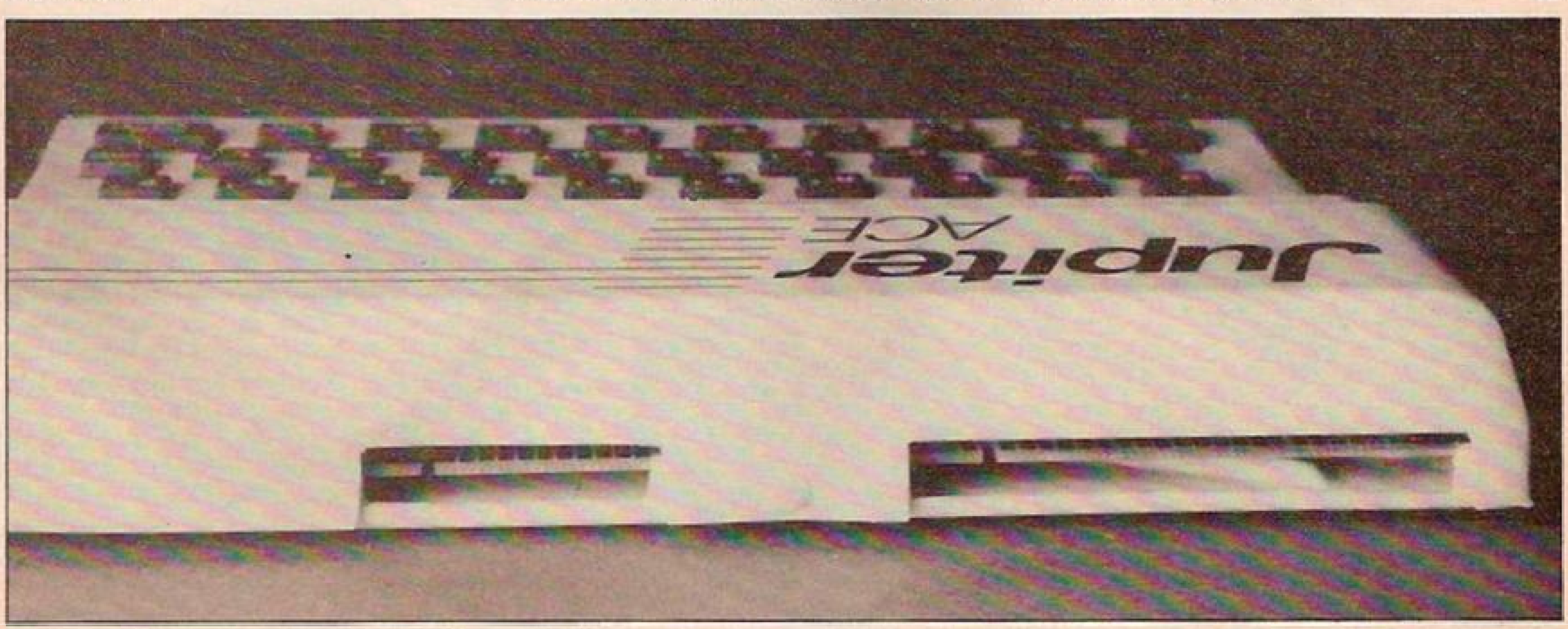
There is also a quartz timer, which doubles as the system clock. This can be accessed from Forth and has a number of possible applications. The timer sorts a number in four bytes,from 15403 to 15406. These can be extracted by use of the fetch word, written as @. I expect the most common use for such a facility will be in the timing of responses and in the generation of random numbers. Here is a very crude random-number generator:

```
: RAND 15403 @. ;
```

Perhaps the way forward for the Ace is best indicated by the other port at the back of the machine. It takes the video lines out from the main card. Eventually it will be used for a colour video generator. ■

CONCLUSIONS

- The success of the Jupiter Ace will depend on the machine-buying public's acceptance of another microcomputer language.
- The machine's development is certainly a brave gamble on behalf of its manufacturers.
- It will be of great interest to scientists, those with control applications, ZX-81 machine-code fans, educationalists and professional programmers who feel they cannot ignore the language.
- Home-computer users who have progressed beyond the beginner phase will like the language and the price but may balk at the lack of true high-resolution and colour graphics.



HARD COPY FOR M

Inexpensive printers for home computers were comparatively rare until recently. Simon Beesley takes a hard look at hard copy for the BBC Micro, Dragon and ZX machines.

UNTIL RECENTLY the Sinclair ZX Printer was unchallenged as the only low-cost printer available for micros. The Vic printer costs £230 and the cheapest printer for machines with RS-232 and Centronics ports is the Seikosha GP-100 for around £180. This prints an 80-column line and has full graphics capability but its price would probably be thought prohibitive by most home users.

The Amber 2400 costs £80.44 and can compete with the ZX printer on the same terms. It can be used on any machine with serial RS-232 or parallel Centronics ports. These are present on the Dragon, the Atom and the BBC. An RS-232 cable for the BBC Micro costs £6, parallel cables cost £11.44. Amber Controls also supplies an interface and cable for the ZX-81 and Spectrum at £21.85 and for the Vic-20 at £20.81.

The Amber 2400 is a dot-matrix printer which uses an inked ribbon on plain paper. It gives 24 characters a line in upper or lower case at a rate of 0.7 lines a second.

The cash-register-type roll is housed in a rugged and well-finished casing. While substantially heaver than the ZX printer it is small enough — 8cm. by 16cm. by 16cm. — to be portable. A line-feed button is the only hardware control.

The great merit of the Amber 2400 is its print quality. On the ZX Printer characters are often indistinct. Using a ribbon on plain paper, rather than Sinclair's aluminium-coated paper, means that the Amber's characters are remarkably clear.

Two of the six control codes which can be sent to the printer select double-width or double-height print. Four different character sizes can thus be obtained: normal — seven-by-five dot matrix; bold height — 14-by-five; bold width — seven-by-10; bold height and width — 14-by-10. The other control codes set the graphics mode, indented print format, carriage return and cancel previous codes.

In graphics mode the bit pattern of each byte sent from the computer is printed as a single line of eight dots. With 144 dots per line from a width of 18 bytes, detailed graphic printouts can be built. Amber's user manual gives two programs to print from the screen display on the Dragon and the BBC. These are rather slow but could probably be improved on.

The commands for listing or printing a string differ with the computer used. On the Dragon, for example, LList prints a listing, while on the BBC VDU 2 enables all output to the screen to be also sent to the printer.

Similarly variable is the extent to which control codes can be passed to the printer by control keys — rather than in a Print or VDU statement.

Since the code for ZX-81 characters is not standard and the Amber only accepts ASCII code there are problems in using this printer with the ZX-81. Amber's ZX-81 interface does not accept LList, LPrint or Copy, and the user must enter two software routines to send single bytes to the printer and convert to ASCII. This only allows you to print the contents of a string, not a listing.

Taking a listing from the Spectrum is possible but again you must first enter machine code and Basic programs. In view of this limitation the Amber cannot at present be considered a suitable alternative to the ZX printer for Sinclair machines. An adequate interface with the necessary software in ROM is what is needed.

But for other machines it fills the same role as the ZX Printer with the advantage of being considerably more versatile and more economical to run. Paper rolls are cheaper, costing £2.97 for five rolls as compared with £11.25 for five of the Sinclair rolls. The ribbons which cost £1.90 come in an easily-changed cartridge and last for around three 88 ft. rolls.

The facility for indenting carried-over lines by one space improves legibility but 24 columns are rather too few for a really satisfactory listing. However this drawback is compensated for by the clarity of the print and the choice of four different text sixes. Further

Below, left to right, an SP-42 printer, an Amber 2400 and a Model 81 with ZX-81 interface attached.



MICROS

details from Amber Controls Ltd, Central Way, Walworth Industrial Estate, Andover, Hampshire. Telephone: 0264-65951.

Dean Electronics supply two Alphacom thermal printers with 40-column lines. Like the Sinclair printer they use an electric pulse from a moving stylus to burn the characters from aluminium-coated paper. They take 4.2in. thermal paper rolls which are 130ft. long and cost £1.30 each. Print speed is two lines a second.

The Model 81 for £108, complete interface board and leads, runs on the ZX-81 but will also work on the Spectrum when Sinclair release the RS-232/Network board. The full Sinclair character set including inverse and graphic characters is available.

The print quality is not as fine as the Amber's but somewhat better than the Sinclair Printer's: the blue characters show up more distinctly against an off-white background.

A paper-release lever makes fitting the roll relatively simple. There is also a power switch and a paper-advance switch. The unit measures 10.5in. wide, 7.5in. deep and 4in. high. Compared to the ZX Printer it has a reassuringly solid feel to it.

The ZX-81's printer commands cannot be used. Instead it is necessary to make USR calls to machine-code routines provided on an EPROM which is plugged into the interface board. These provide three facilities in either regular or enhanced mode. You can list, print a string, and dump the contents of the screen to the printer. Enhanced mode prints double-size characters.

```
LET Z = USR 8204
```

for example, will print a listing in enhanced mode. Rather inconveniently, the ZX-81 needs to be in Fast mode before the printer can be used.

The ZX printer costs £59.95; at nearly twice the price, the Model 81 will only offer an alternative to those who value a far clearer printout and the option of enhanced mode.

The SP-42 is a slightly smaller version which can run on machines with RS-232 and Centronics ports. Dean Electronics also provide interface modules for most other machines like the Atari, the Pet and the TRS-80.

Like the Amber, commands to the printer are specific to the machine used.

```
PRINT #-2, A$
```

for example will print the string A$ from the Dragon.

Control codes provide features like vertical tab, line feed and carriage return. Sending the character-orientation code indicates which way up a character is to be printed — normal or upside down. Again, as on the Amber, the graphics mode can be set to plot a "bitmap". The printer recognises 95 ASCII characters as printable and prints in upper and lower case.

Dean Electronics are at Glendale Park, Fernbank Road, Ascot, Berkshire. Telephone: 0344-885661. ■

```
THIS IS AN EXAMPLE OF THE PRINT-OUT FROM
 THE DRAGON COMPATIBLE THERMAL PRINTER.T
HIS IS AVAILABLE FROM :
DEAN ELECTRONICS LTD.
GLENDALE PARK
FERNBANK ROAD
ASCOT,BERKS
THIS IS AN EXAMPLE OF THE PRINT-OUT FROM
 THE DRAGON COMPATIBLE THERMAL PRINTER.T
HIS IS AVAILABLE FROM :
DEAN ELECTRONICS LTD.
GLENDALE PARK
FERNBANK ROAD
```

Hard copy from the Dean Electronics' SP-42.

CONCLUSIONS

- ■ The Amber 2400 costs only £20 more than the ZX printer but is considerably more versatile. It can interface with most popular micros at no extra cost other than the price of connecting leads.
- ■ The use of economical plain paper and inked ribbon makes for a very clear printout from the 2400.
- ■ The Amber benefits from the option of four different print sizes and a graphic mode; these facilities are easy to set through six control codes.
- ■ The Amber's only drawback is that the width of the printout — 24 columns — is too narrow for satisfactory listings.
- ■ The Dean Electronics Model 81 for the ZX-81 costs some £50 more than the ZX Printer but gives a better print quality.
- ■ Sending commands to the Dean printer is less straightforward than on the ZX Printer but it offers enhanced mode as an extra.
- ■ Like the Amber the SP-42 can interface with a wide range of micros but at £150 costs substantially more.
- ■ Print quality is not quite as clear and it does not offer as many print sizes.
- ■ In its favour are a 40 — as opposed to a 24 — column line and a faster printout. These make it more suitable than the Amber for serious applications.



```
DOUBLE WIDTH
Double Height
Double Width
and Height
LIST110,230
  110 REM PRINT GRAPHICS
  120 *FX5,1
  130 FOR Y=576 TO 0 STE
P -4
  140 A%=&11:VDU1:PRINT
CHR$(A%);
  150 FOR X = 0 TO 576 S
TEP 32
  160 A%=0:B%=128
  170 FOR X1 = X TO X+12
8 STEP 4
  180 IF POINT(X1,Y)=3 T
HEN A% = A%+B%
  190 B%=0.5*B%
  200 NEXT X1
  210 VDU1:PRINT CHR$(A%
);
  220 NEXT X:NEXT Y
  230 REM PRINT TEXT
```

Amber output.

```
THIS IS AN EXAMPLE OF THE ENHANCED TYPE
IN THIS ZX81 COMPATIBLE PRINTER

AND THIS IS THE REGULAR TYPE ON THIS
ZX81 COMPATIBLE PRINTER.
FULL DETAILS ARE ON THE ATTACHED DATA
SHEET.

THIS IS AN EXAMPLE OF THE ENHANCED TYPE
IN THIS ZX81 COMPATIBLE PRINTER
```

Dean Electronics' Model 81 — sample printout.

SILVERSOFT

NEW!

SPECTRUM – BBC – ZX81

STARSHIP ENTERPRISE

Soar through the stars as a starship commander in this exciting new space ship simulation. This new, advanced version of Startrek uses the full colour graphics and sound facilities of modern micros. Full 3D – Klingon attacks, graphic hyper-warp, plus all the normal 'Startrek' features and a whole lot more, add up to one of the best games in the galaxy!!
48K Spectrum £5.95. BBC Micro model 'B' £6.95.

ORBITER

Fast and furious action is what you get in this amazing Defender-style program for the ZX-Spectrum.
ORBITER is written entirely in m/c code and has full arcade features, including scanners, reverse, hyper-space, continuous scoring and sound effects, plus humanoids, landers, mutants and all the other alien nasties. 16K or 48K Spectrum £5.95.

GROUND ATTACK

Survival is the name of the game in this exciting Scramble-type arcade game for the ZX-Spectrum.
Your mission is to pilot your spaceship through tortureous caverns while destroying the enemy missile launchers and fuel dumps.
GROUND ATTACK is written completely in machine code. And has full arcade features including lasers, bombs, explosions, continuous scoring and sound effects, plus rockets, fuel dumps and airborne aliens. 16K or 48K Spectrum £5.95.

Any hiring, lending or copying (except backup) of Silversoft software is strictly forbidden without written permission from Silversoft.

GENEROUS DEALER DISCOUNTS AVAILABLE
Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.

KILLER SATELLITE

A mysterious Black Box has appeared in earths' orbit. You have to send your killer satellite to Probe it with high energy lasers. Amazing 3D colour graphics and sound for the Model B only £5.95.

3D CONNECT 4

An advanced, challenging four in a row game for the BBC Micro. Displayed in full 3D-perspective and using the extensive colour and sound facilities of the BBC Micro. Model B only £5.95.

NEW! ZX81-COMPILER

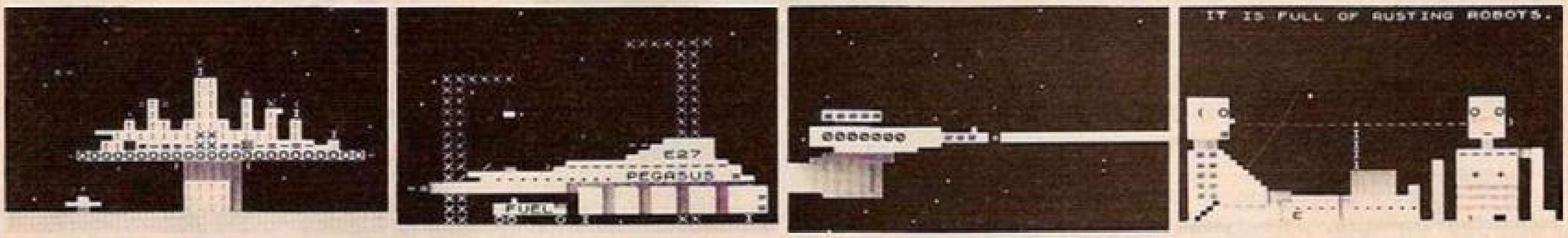
Yes! Now you can write machine code on your ZX81. No more messing about with assemblers and disassemblers simply type in the BASIC program and the machine does the rest.
ONLY £5.95.

ZX81 ARCADE ACTION (New low prices)

MUNCHER Exciting pacman game for the ZX81	**£4.95**
ASTEROIDS "Just the thing for asteroid addicts"	**£4.95**
INVADERS "Probably the best version of INVADERS"	**£3.95**
ALIEN-DROPOUT Exciting ORIGINAL arcade game	**£3.95**
STARTREK YES! you can be a starship commander	**£3.95**
GRAPHIC GOLF 18 graphically displayed holes	**£3.95**
SUPERWUMPUS An underground adventure	**£3.95**
GAMES PACK 1 Fantastic value for money, nearly 50K of programs on one cassette! Only	**£3.95**

Please send me ______
I enclose a cheque/PO for £ ______
Name ______
Address ______

Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED. YC11



And now for the big picture.

TRADER A trilogy of 16K programmes that combine to give an epic 48K graphic adventure. As a galactic trader, you deal with some very bizarre customers indeed. Will you live to tell the tale? ZX81 £10.50. VIC20 £18.50 (tape or disc).

SUBSPACE STRIKER Our top selling, big screen graphic game. With your deadly Antimat torpedoes, you unleash havoc in the Federation spacelanes and try to dive back to the safety of subspace, fast. ZX81 £5.50. VIC20 £9.50. 16K.

STARQUEST A voyage of discovery and adventure in the cosmos. With the help of your onboard computer, you seek a habitable planet amidst the perils of deep space. ZX81 £5.50.VIC20 £9.50. 16K.

ENCOUNTER Would you know what to do if you encountered extra-terrestial beings? In this adventure, you are snatched off the Earth and the space invaders play YOU! ZX81 £5.50.VIC20 £9.50. 16K.

ZOR Battle of the robots. Fight for survival in this action-packed strategy game. Megajoules of destructive energy in a futuristic duel. ZX81 £5.50. VIC20. £9.50. 16K.

PIXEL POWER At last it is easy to create your own custom characters on the 8K plus expanded VIC20. A graphics workshop packed with useful features like Create, Amend, Save, View Set. £9.50. Refreshes the pixels that other programmes can't reach. (See Pixel Power in action in Trader and Subspace Striker)

HARVESTER Reap your reward in the Boosterspice fields around the planet Delta. A cut-throat strategy game for 2 to 4 players for the unexpanded VIC20. £4.50.

BRAINSTORM The telepathic emissions of the friendly Psions can wreck a human brain. Can you get our three space explorers across a river of nasty goo without blowing their minds. Unexpanded VIC20. £4.50.

GUITARPIX 1 For the VIC20 owner who wants to play the guitar. The first of a series that shows how to tune the guitar and demonstrates some elementary chords. Unexpanded VIC20. £4.50.

Send SAE for more details.

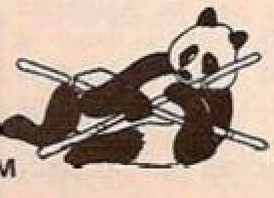
PIXEL

Pixel Productions 39 Ripley Gdns. London SW14 8HF

STONECHIP ELECTRONICS

NEW! **PRODUCTS FOR VIC-20, SPECTRUM, ZX81**

ZX81 USERS
THE ZX-PANDA



UNIQUELY EXPANDABLE 16K RAM PACK
EXPANDABLE INTERNALLY BY PLUG-IN MODULE TO FULL 32K
ATTRACTIVE CUSTOM MADE CASE CONTOURED TO REAR OF ZX81 FOR MAXIMUM STABILITY
COMPACT SIZE. LED POWER INDICATOR
COMPATIBLE WITH MOST EXPANSION SYSTEMS

ZX-PANDA	16K EXPANDABLE RAM	£25.00
ZX-PANDA	16K EXPANSION MODULE	£19.95
	OR FULL 32K EXPANDED	£39.95



ZX SPECTRUM OWNERS
SPECTRUM ECHO

MAKE FULL USE OF YOUR SPECTRUM'S SOUND FACILITY BY AMPLIFYING IT! ENABLES LOADING AND SAVING TO TAPE WITHOUT SWITCHING LEADS
NO ADDITIONAL POWER SUPPLY REQUIRED
OTHER FEATURES INCLUDE:
* TONE AND VOLUME CONTROL
* AUDIBLE CUEING FACILITY
* DIN COMPATIBILITY
* ATTRACTIVELY CASED

£23.50

VIC-20 OWNERS

Fully Assembled, Cased and Guaranteed

MASSIVE 16K RAM MEMORY EXPANSION

PLUGS DIRECTLY INTO YOUR VIC-20 OR MOTHERBOARD

£39.95

EXPAND YOUR VIC-20 WITH

Tandem

3+1 EXPANSION UNIT
FOR USE WITH MEMORY AND GAMES CARTRIDGES
MORE THAN 1 UNIT CAN BE USED IN TANDEM TO GIVE EVEN MORE EXPANSION
INCLUDES ROM SOCKET
PLUGS DIRECTLY INTO YOUR VIC-20 EXPANSION PORT
ATTRACTIVELY CASED

£34.95

PLEASE SEND ME: ....
....
....
I enclose £ ....
NAME..
ADDRESS ....
....
....
YC11

Send now to:
**STONECHIP ELECTRONICS,
UNIT 4, HOSKINS PLACE, WATCHETTS RD, CAMBERLEY,
SURREY. TEL: (0276) 681131**
MAKE CHEQUES OR P.O.'s PAYABLE TO: STONECHIP LTD

ALL PRODUCTS FULLY ASSEMBLED, TESTED AND GUARANTEED
ALL PRICES FULLY INCLUSIVE
ALLOW 28 DAYS DELIVERY

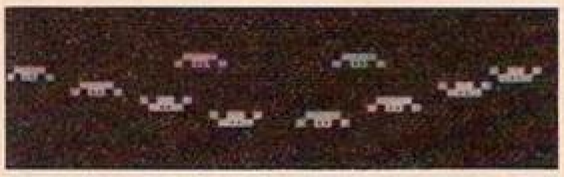
Eric Deeson has an entertaining time checking out the latest batch of ZX-81 games.

MANY GALAXIAN ADDICTS will be very happy with Artic's version, a short, but satisfying, machine-code product. It is not outstandingly fast, so that means high scores with the owner's name come thick and fast.

Abersoft's machine-code invaders follows the standard routine closely, is adequately designed and speedy; surprisingly, though, Break is not masked.

A new Breakout-type arcade game for the ZX programmer, Blastout, recently appeared on the Planet Software label. The control keys are Z and X — not a good choice, but the game is fast, with a reasonable attempt at making Sinclair graphics represent Breakout colours.

The first ZX Phoenix has appeared in the guise of Work Force's Winged Avenger. The copy reviewed was pre-production and it took a while to work out which keys to press, but this prototype has great promise — look out for the real thing. Asteroids is a popular arcade



game which ZX writers are strangely reticent in tackling. Silversoft is one of the few to attempt the game. The result, Meteor, is a trifle pricey at £5.95, but is a fully-fledged implementation.

Now for the Pac-Man-style batch. It is hard to do justice to them all — there are four close copies, plus the unusual Gulp from Campbell Systems. Its menu includes excellent instructions, and a choice of maze and speeds. There is only one gulper but one is quite enough. The four others include Zuckman by DJL Software, Zedman by Babtech, Mazeman by Abersoft, and Artic's Gobbleman.

The steady flow of Adventures for the ZX-81 all have the same basic skeleton: a quest for something, barriers to overcome, a track to find and fights to fight. Some scroll, as opposed to giving the rather dreary standard print and display. Non-graphic Adventures are now becoming thin on the ground. Even the collection of three from Phipps includes simple little map fragments. Although in a different league from the fully graphic games, I like this cassette — three classic adventure scenarios for £5 seems reasonable.

Well documented

Sorcery from Saxon Computing, is a well-documented Adventure set in Arthurian Britain. Although I liked it, I found it remarkably unpolished in a number of ways and there was one serious bug: on being confronted by a cliff-face, I moved east and was mysteriously transported into a totally different scenario.

Moving on to look at adventures with pictures, I was particularly taken by Mazogs from Bug-Byte; the name is a compound of maze and trogs. The graphics are impressive, consisting of a two-dimensional maze in which you control a running figure, looking for a sparkling silver bar. The Mazogs are monsters patrolling the maze — wonderful black elves who have to be seen, with rubbed eyes, to be believed.

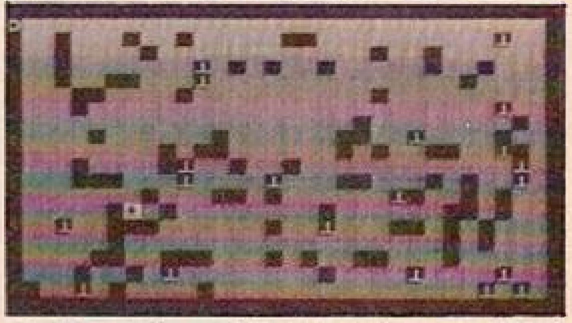
Assistance comes in the form of a sword with which to clear the way; the maze walls also enclose prisoners who can give you directions to the treasure. Of course when you do find the treasure, you have to escape from the maze — and with the treasure you cannot carry a sword.

That particular maze game is certainly a hard one to follow, but Doric Computer Services' Oracle's Cave is a well-executed, though somewhat slow, fully-graphic adventure game, for one or two players. There is a choice of quests and the status of each player is continuously displayed. Apart from some grammatical lapses and the lack of indication of your current position on map, this remains an extremely competent product.

Scout from Deltasoft, an impressive German ZX Software house, is an ingenious mixture of



Missile Command and Fighter. It comes with nine neat key overlays and an excellent booklet, whose English puts many U.K. suppliers to shame. During the game you must destroy



the 27 attackers without running out of fuel, oxygen, ammunition or shields. The three-dimensional graphics and other little tricks makes this a game which you will enjoy for a long time.

Several three-dimensional mazes have appeared lately. Apart from J K Greye's archetypal Monster Maze, Planet Software's version is perhaps the most impressive. Excellent graphics mixed with nice touches of humour and a turn of speed make a worthwhile combination.

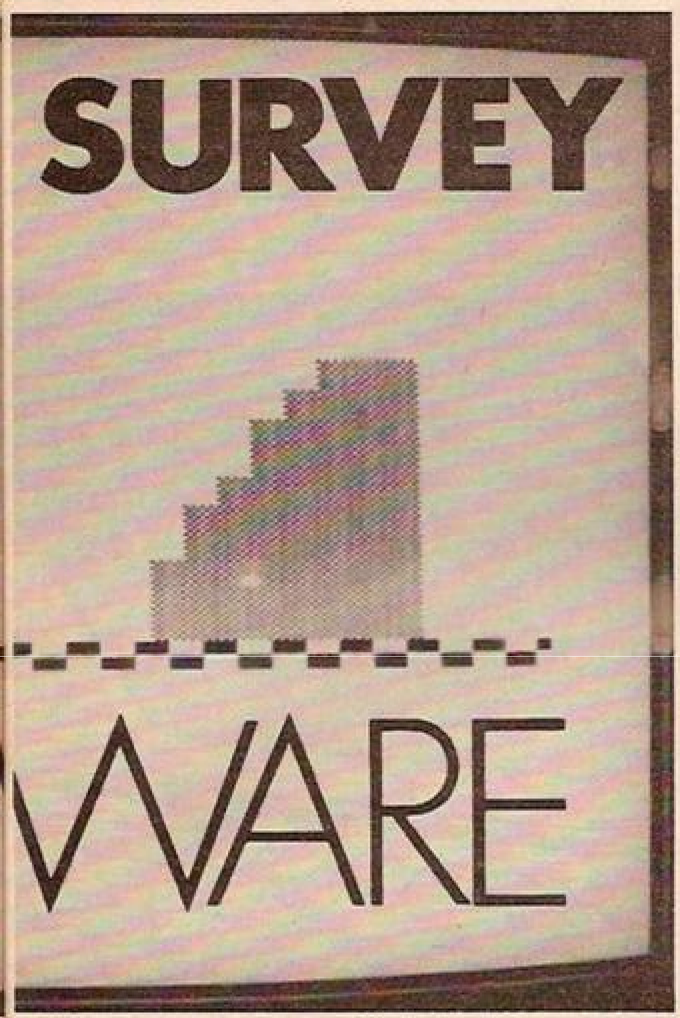
A standard type of graphic adventure is Damsel and the Beast from Bug-Byte. This is not one of the company's best — a purely Basic product with no written or internal instructions and no zip at all.

Quite the opposite is 3-D Defender from J K Greye. This is his fifth Gamestape and it is comparable to Monster Maze. This new product is just as innovative as standard Defender, but your view is from the cockpit rather than from the ground. A display of instruments is shown, together with the sky and approaching fliers. Key layout is good; there is a choice of keys for each function. 3-D Defender demands a lot of skill.

Perhaps most original of all the new graphics adventures is Newsoft's Time Bandits. The

Suppliers and addresses
Code

1 **Abersoft** 7 Maes Afallen, Bow Street, Dyfed.
2 **Addictive Games** 2676 Conniburrow Boulevard, Milton Keynes.
3 **Aquarius Software** 53 Towncourt Crescent, Petts Wood, Kent.
4 **Artic Software** 396 James Reckitt Avenue, Hull.
5 **Babtech** 3 Baberton Mains View, Edinburgh.
6 **Bobker** 29 Chadderton Drive, Unsworth, Bury, Lancashire.
7 **Bug-Byte** 98-100 The Albany, Old Hall Street, Liverpool 3.
8 **Campbell Systems** 15 Rous Road, Buckhurst Hill, Essex.
9 **Cases Computer Simulations** 14 Langton Way, London E3.
10 **Deltasoft** Osterfeldstrasse 79d, D2000 Hamburg 54.
11 **Digital Integration** 22 Ash Church Road, Ash, Aldershot, Hampshire.
12 **DJL Software** 9 Tweed Close, Swindon, Wiltshire.
13 **Doric Computer Services** 17 Claybrook Avenue, Leicester.
14 **J K Greye** 16 Park Street, Bath, Avon.
15 **Newsoft** 12 Whitebroom Road, Hemel Hempstead, Hertfordshire.
16 **Michael Orwin** 26 Brownlow Road, London NW10.
17 **Phipps Associates** 3 Downs Avenue, Epsom, Surrey.
18 **Planet Software** 10 Norton Drive, Eaton, Norwich.
19 **John Prince** 29 Brook Avenue, Manchester 19.
20 **Quicksilva** 92 Northern Road, Southampton 2, Hampshire.
21 **Saxon Computing** 3 St Catherine's Drive, Leconfield, Humberside.
22 **Richard Shepherd** 22 Green Leys, Maidenhead, Berkshire.
23 **Silversoft** 35 Bader Park, Bowerhill, Melksham, Wiltshire.
24 **Vortex Software** 16 Crawford Road, Hatfield, Hertfordshire.
25 **Workforce** 140 Wilsden Avenue, Luton, Bedfordshire.



source of the idea is obvious from the title; the real novelty is in the thoughtful implementation. On side A you have the chance to practise any of the five sub-games. When you graduate to side B, you experience the entire gamut in one game.

Aquarius Software has added another Star Trek to the several that already exist. Unoriginal and rather slow — being pure Basic — this program is cheap and does follow the well-defined rules. Much more interesting is Cosmos from Vortex Software. This is the pick of the company's batch, and a splendid machine-coded combat it is. You dart around space defending a convoy from alien spacecraft. Controls, once mastered, are good, and so are the score displays.

Remaining in orbit, Richard Shepherd's Space Mission provides great competition. The graphics for this space combat are spectacular, and the program shows great attention to detail. There are seven skill levels.

A simulation is a serious gaming product which tries to mirror some aspect of real life and perhaps even teach concepts or skills. One example of this is Football Manager from Addictive Games.

Management heavy

In this you play the role of a management heavy, buying and selling players, borrowing money, playing league games and generally enjoying the hurly-burly of screen life. A cunning tension-building device is the newsflash display which keeps you up to date on how your team is doing in a match.

Microcomputer flight simulations are becoming commonplace. A great one from a newcomer to the ZX scene, Digital Integration, is Fighter Pilot. Partly machine-coded and relatively fast, this game allows you to choose to practise landings or to attempt a full take-off, circuit, landing sequence. All this is pure instrument flying — 10 displays to watch and eight controls.

Night Gunner, another cassette from the same company, put you in the control seat of a rear gun, with targets weaving around in the night sky.

One company apparently going all out in the simulations direction is Cases' Computer Simulations. It has two products of the computerised board-game type, Autochef — in which you have to build up a fast food empire, and Airline — in which you emulate Freddie Laker.

Class of its own

In a class of its own is a new ZX chess, from Abersoft. This is extremely easy to use, plays very well and has seven levels giving black and white choice plus offering Copy. It is, in my opinion, the first piece of software to succeed in representing chess pieces with Sinclair graphics.

Michael Orwin's Cassettes 3 and 4 each have eight reasonably lengthy 16K games for £5. These contain a good blend: Adventure games, Invader-style material, serious games like Life and less serious ones like Oxo. Orwin's own name appears as author for only one of the 16 games — Fungaloids — but it is the pick of the bunch, a cross between Defender and Triffids.

Richard Shepherd's Bargain Bytes appeared in April, claiming to be first of a series, although further collections have been tardy in appearing. At £5 for eight 16K programs, each recorded once, this seems to be direct competition for Orwin. The games — fine as far as they go in stolid, uninspired Basic — are, however, hardly novel. There is a Hangman, a Mastermind, a Depthcharge, and two Adventures, one undersea, the other underground. The Adventures are Shepherd's main games on this cassette; they follow the usual format and tend to be rather slow, but this does not seriously detract from Adventure games.

John Prince has tried to go one better with his Astro-Invaders collection, but the Invaders itself is rather strange — it takes a while to figure out the controls, which turn out to be a trifle slow-acting. Some of the effects are quite nice, but there are many better implementations around. Prince's makeweights on the £3.65 cassette are better, even if not original — Grand Prix, Penalty, Golf and Swat.

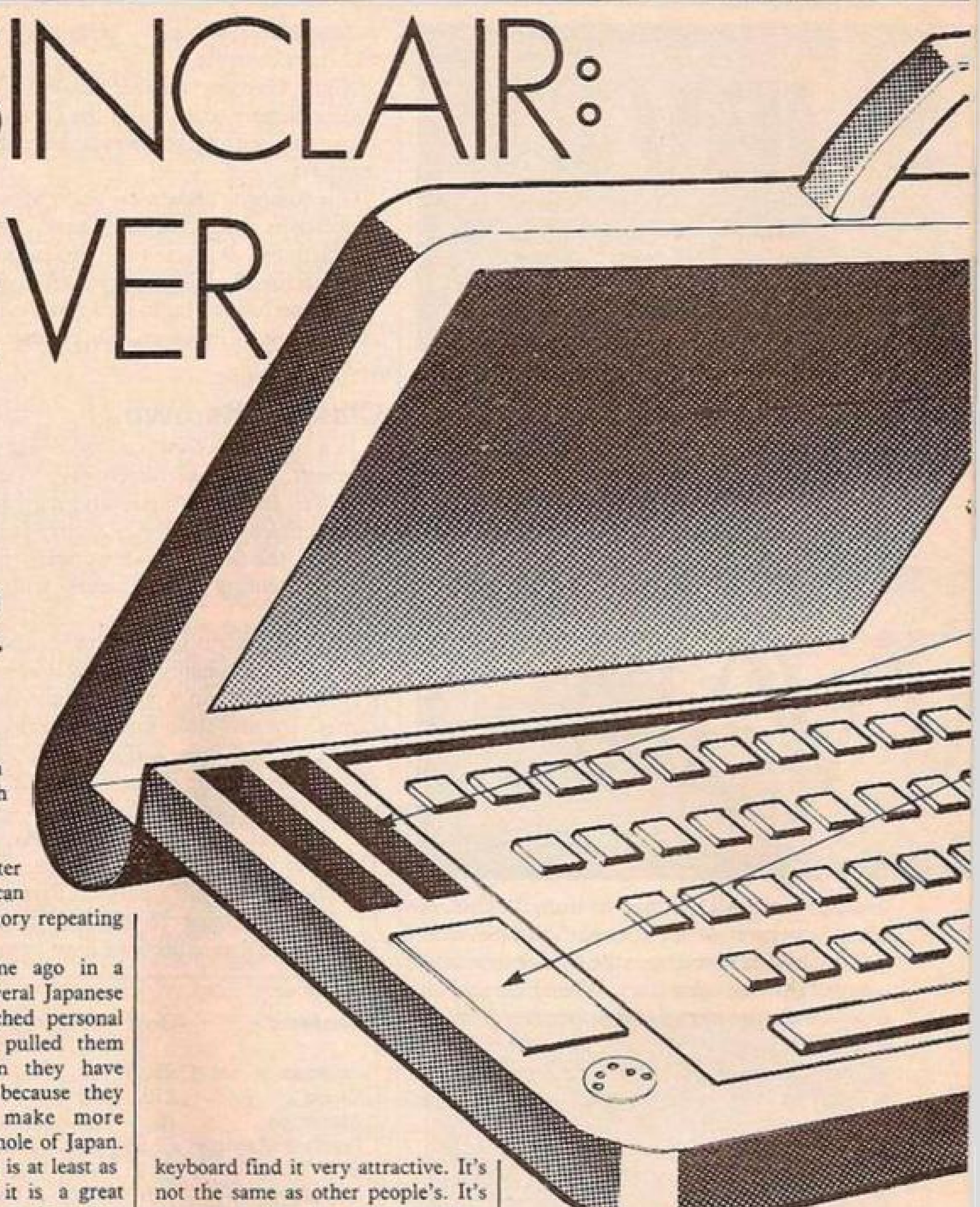
CONCLUSIONS

- The ZX-81 software market continues to be a very difficult one. Roughly 1,000 cassettes are available for this machine in Britain alone.
- There is a tendency for prices to fall and quality to rise, but slowly.
- Of course, there are some superb ZX games around now — but there is a whole load of rubbish riding on their backs, sometimes even from the same suppliers. Let the buyer beware. ■

Cassette	Cost	Code	Description	Assessment A	B	C	D	E	F	G	H
Invaders	£5	1	Arcade	—	5	4	3	4	3	4	1
Chess	£10	1	Full graphic	—	5	4	5	5	5	5	3
Mazeman	£5	1	Arcade	2	5	4	3	4	4	4	3
Football Manager	£7.95	2	Simulation	4	5	4	4	4	3	—	4
Star Trek	£3.95	3	Standard	4	5	3	3	3	2	2	2
Gobbleman	POA	4	Pac-Man-style	—	3	3	4	4	5	4	3
ZX Galaxians	£3.95	4	Arcade	—	5	4	5	5	4	4	4
Zedman	£5.95	5	Plus Invaders	—	5	4	3	4	4	4	4
Venture	£5	6	Seven in One	0	5	4	4	3	3	4	5
Mazogs	£10	7	Maze Adventure	4	5	5	4	5	5	5	5
Damsel & Beast	£6.50	7	Adventure	—	5	3	1	2	3	1	2
Gulp!	£4	8	Novel Pac-Man	2	5	5	4	5	5	5	5
Autochef	£4.75	9	Simulation	1	5	3	3	2	3	—	3
Airline	£4.75	9	Simulation	1	5	3	3	3	3	—	3
Scout 1	POA	10	Space fighter	5	5	5	2	4	4	5	4
Night Gunner	£3.45	11	Target	4	5	4	3	4	4	4	4
Fighter Pilot	£3.45	11	Simulation	3	5	4	3	4	4	—	4
Zackman	£5.95	12	Arcade	—	3	4	3	3	3	3	3
Oracle's Cave	POA	13	Graphic adventure	3	5	4	4	4	3	4	4
Defender	POA	14	Arcade-type	2	3	5	2	4	4	4	4
Time Bandits	£4.95	15	Complex adventure	1	5	3	3	4	4	4	5
Cassette 4	£5	16	Eight games	2	4	3	3	4	4	4	3
Cassette 3	£5	16	Eight games	3	4	3	4	4	3	3	4
Adventure	£5	17	Three of them	—	5	4	3	3	3	1	2
Blastout	POA	18	Arcade	1	5	4	3	5	3	4	3
3-D Maze	POA	18	As title	—	5	4	4	4	4	4	3
Astro-invaders	£3.65	19	Plus four small games	—	5	4	3	2	2	3	1
Scramble	£5.50	20	Defender plus	1	5	4	3	4	5	5	4
Sorcery	£4.95	21	Adventure	2	5	2	3	3	3	—	3
Space Mission	£6	22	Complex, arcade-type	—	5	5	5	4	5	5	4
Bargain Bytes	£5	22	Eight programs, four games	4	5	3	4	3	3	2	1
Asteroid	£5.95	23	Arcade	—	5	4	4	4	4	3	3
Cosmos	£5.99	24	Graphics, Space	—	5	4	4	4	5	4	5
Winged Avenger	£5.95	25	Phoenix	—	5	4	3	4	4	4	4

The assessments in this table range from 0-5 under the following heads: A, documentation; B, ease of loading; C, format/screen layout; D, ease of use; E, functional value; F, programming quality; G, graphics quality; H, novelty.

CLIVE SINCLAIR: WHATEVER NEXT?



One name is stamped indelibly on most British computers — Sinclair. Now Meirion Jones finds out what else Clive has in store.

CLIVE SINCLAIR epitomises all that is best in British industry — or at least people in high places think so. When Margaret Thatcher presented the Japanese Prime Minister with the latest Sinclair machine in front of a television audience of hundreds of millions, many must have been delighted at this demonstration of Britain outdoing the Japanese in high-technology consumer goods.

Others who, after four months, were still waiting for their Spectrums to be delivered or whose machines had proved unreliable on arrival may have viewed the spectacle with less enthusiasm. But love him or loathe him, no-one can deny Sinclair's pre-eminence in silicon Britain or his startling record of technological innovation. In the early 1970s he produced the world's first pocket calculator and followed it up with the Black Watch — the first to have all its electronics on one chip.

He opened this decade with the ZX-80, the first mass-produced home computer and soon followed it up with the ZX-81 and Spectrum, selling 500,000 computers in three years.

Now Clive Sinclair has become as synonymous with computers as Hoover is with vacuum cleaners. Yet unfortunately Sinclair's ventures have not always been as successful as expected. His calculator was soon overwhelmed by competition from the Far East and his digital watch had to be withdrawn because of unreliability and delivery delays, leaving the field clear for the Japanese.

Partly in response to these tribulations he has developed an unusual way of working. Despite a turnover of £30 million a year and rising, he employs just 50 people who concentrate on research, development and marketing while he farms out production of his proven inventions: "We're a nexus; we cause things to happen then stand back." With customers grumbling about delivery delays and a Japanese computer invasion on the cards can Clive Sinclair stop history repeating itself?

"That's a long time ago in a different business. Several Japanese companies have launched personal computers and then pulled them out. Time and again they have failed; they are out because they can't get in. We make more computers than the whole of Japan. As long as our volume is at least as high as theirs — and it is a great deal higher — I don't see how they can compete. They can't do it at a low price".

If the Japanese cannot do it, how about Binatone's computer with 16K colour and sound for £50 to be launched in January? — "I'll believe it when I see it. Binatone wouldn't know how to design the thing and we don't know of anyone in the Far East who could do it for them."

'We make more computers than Japan'

Sinclair's £125 Spectrum has become the standard by which other micros are judged: — "We started with the ZX-81, where people wanted something extra — a moving-key keyboard, colour and sound and a larger internal memory. The Spectrum was a solution to that." While the 16K of RAM and quality of colour were an instant success, the keyboard was criticised for its lack of a full-size space bar and for what one rival called the "dead-flesh" feel of the keys.

"People who've actually used the keyboard find it very attractive. It's not the same as other people's. It's our own design, low cost to produce but very satisfactory." But even Sinclair has to concede that it does not make word processing easy: "The keyboard may be a limitation but you could put another keyboard on it if you were really that desperate."

The success of the Spectrum has brought its own problems. Hundreds of Sinclair customers have written to or telephoned *Your Computer* to complain about delivery delays. "They're entitled to complain and we don't take it lightly. We did get things wrong but we've moved heaven and earth to correct it — the criticisms are justified and we'll make damn sure it doesn't happen again."

What angered customers most was Sinclair's failure to give realistic delivery dates and the lack of information about problems with the Spectrum's printed circuit board and power pack which have since been solved.

Sinclair prefers to interpret the delays as a back-handed compliment to the Spectrum. "Yet again, we've been amazed by the demand. It's not that we don't learn, it's just that this time we deliberately didn't advertise in the national press to start with in order to restrain demand.

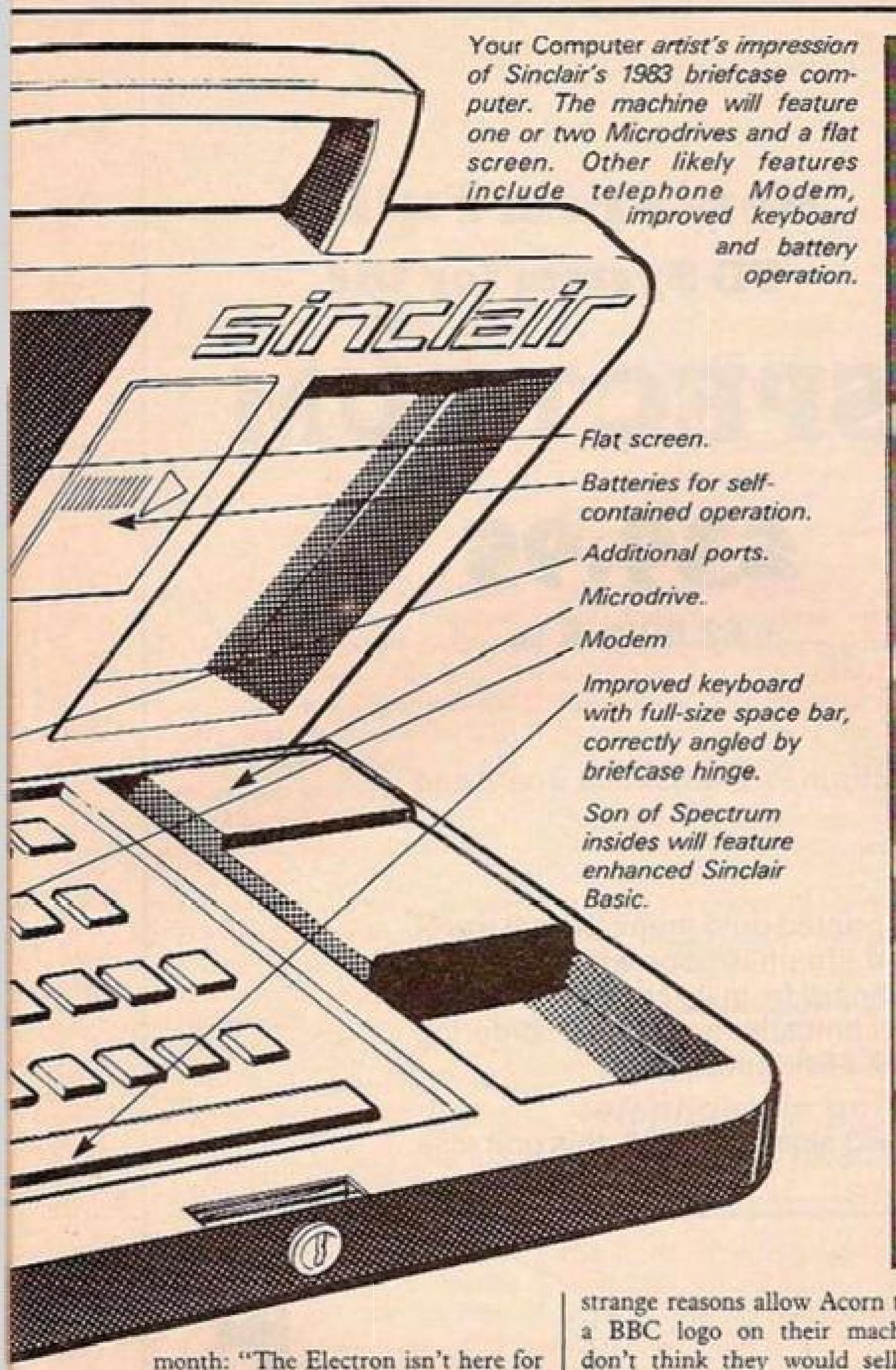
"Nonetheless sales of the Spectrum have been just as high as with the ZX-81 which we advertised nationally despite the fact that it is more expensive. In addition we've been behind schedule but we're on schedule now and catching up rapidly."

Clive has little time to read micro magazines: "There are so many that I only have time to glance at them" but he had read September's *Your Computer* interview with Hermann Hauser of Acorn with more than passing interest.

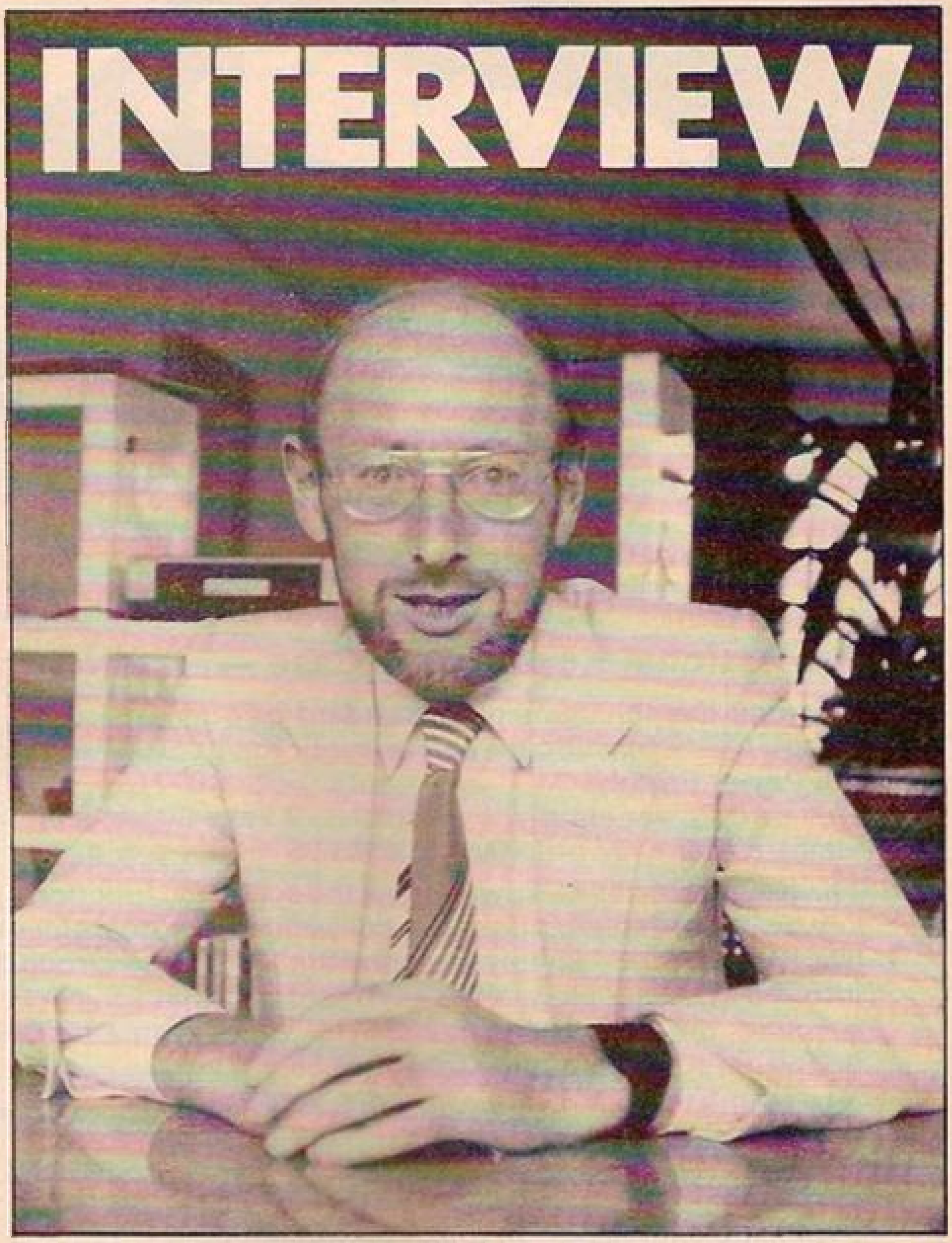
'They're entitled to complain and we don't take it lightly'

Ever since the BBC chose Acorn rather than Sinclair to produce the BBC Micro, the Cambridge air has been suitably blue with allegations and counter-allegations between the rival firms. Sinclair is particularly scathing about Hauser's claims for the Electron, Acorn's Spectrum challenger due to be launched next

INTERVIEW



Your Computer artist's impression of Sinclair's 1983 briefcase computer. The machine will feature one or two Microdrives and a flat screen. Other likely features include telephone Modem, improved keyboard and battery operation.



month: "The Electron isn't here for a start — not expected by them until the end of the year — and not by anybody wise until next year. It will come out a year later than the Spectrum and will be way behind it in technology.

"It will have — as Hauser says — more RAM, more ROM, more ULA, for the simple reason that in my view they don't know how to produce a machine half as well as we do. Ours isn't complex if you mean it has fewer chips — but that of course is the clever bit about it. It takes them 32K of ROM to do the interpreter and so on, which we do in 16K: they need 32K RAM minimum because their display takes 20K to do exactly the same as our display does in 8K. It's going to be much more expensive to make than the Spectrum and it only does the same job — in some ways not as well.

"They were announcing it at the same time as we were announcing the Spectrum — by the time it does appear I'm afraid the competition will be so fierce in that sector of the market that I think it will be too late. Hauser says that if he does have a problem, he just picks up the telephone. Well, we don't — we do it all in-house."

Sinclair is no less damming about the BBC machine. "If it wasn't for the fact that the BBC for their strange reasons allow Acorn to stick a BBC logo on their machines I don't think they would sell many computers. Hauser says it's an Apple and Pet competitor. Those machines were designed a long time ago and the Spectrum far exceeds their specification — and so it should, it's up to date."

Hauser's claim that BBC Basic is becoming the standard particularly offends Sinclair's sensibilities: "Sinclair Basic is the most widely used in the world today — by the end of this year half the computers produced in the world will have our Basic on them — if that's not a standard what the hell is?" Sinclair freely admits that his Basic may not be suitable for all applications but rather than restructuring his Basic he believes in "Horses for courses. We will offer a whole range of languages for the Spectrum."

Sinclair damns his other competitors with faint praise. "Commodore is a very effective company but technically way behind. Then again, Commodore makes many machines we don't have anything to compete with." He does not see Commodore's forthcoming Max as a threat either: "It's a games machine, that's all." As for the Dragon and purpose-built Spectrum-bashers like the Oric he will only say "Wait and see".

Next month Clive Sinclair takes the wraps off his most closely guarded secret, the Microdrive. If it is half as good a storage system as he claims, his competitors have much to fear. Until now if you wanted to use your machine to handle information you could either store the data on cassette and wait for hours when you needed it, while the computer found the right pieces of tape, or spend a small fortune on a 5.25in. disc-drive system and do the job properly.

'We have the flat screen, we have the Microdrive'

Now the manufacturers are miniaturising the drives to take 3in. and 3.5in. discs and bringing prices down to size as well. Sony, Hitachi and BATS have all produced small drives which could be on sale for less than £200 by early next year, but once again Sinclair upstaged his rivals by announcing — last St George's Day — that he would release a 100K rapid-access storage system, the Microdrive, for £50.

Sinclair's reluctance to release any further details since April, together with the low price, has fuelled speculation that his micro-floppy might not be a real disc drive. Sinclair will only say "it will do exactly the same job as the other drives" and he is particularly indignant at Hermann Hauser's claim that the Microdrive will be obsolete before its launch.

"The micro-floppy is the most important thing we're doing and contrary to what Hermann Hauser supposes it is actually well in advance of the 3in. and 3.5in. machines that the Japanese are doing and less expensive." As for access times: "They're all a sight faster than any customer is ever going to need, it'll do anything you want it to do. "The Japanese ones even for large volumes will retail at twice our price. I was talking with Adam Osborne about this and he wants to buy ours even though he can buy anywhere in the world".

Like Sinclair, Osborne was once an electronics writer before he started building the briefcase computers which now carry his name and which Sinclair admires. "That portability thing makes it very sexy but the true virtue of his machine is that it's all in one package. You don't have all those cords trailing about to plug together."

It comes as no surprise that Osborne is working on a less cumbersome successor to his present machine incorporating Microdrives. Could Sinclair be working on a lightweight briefcase machine himself?

He has spent 10 years perfecting

(continued on page 41)

(continued from page 39)
the flat-screen television and now has the Microdrive. Both are likely to find a place in next year's new Sinclair, which will not be called the ZX-83.

"That's a likely product. We have the flat-screen technology, we have the Microdrive technology. Late next year we'll have a machine which is not a replacement for anything we have now, and which will have the display and the drives. It is for that reason that I don't think our opposition stands a heck of a chance — because we can do that and nobody else can. Obviously it is going to cost a lot more than the Spectrum."

Next year's model should also step straight into the era of electronic mail. It will incorporate Sinclair's telephone Modem which will become available as a Spectrum add-on early next year for about £50. "When you're linked to the telephone you can send a message from one computer to another, so you've got electronic mail."

The Modem will also allow Sinclair owners to access databases like Prestel and viewdata. Sinclair plans to use Prestel to sell programs. Sinclair owners will be able to download games programs from the telephone line. "It's a good way to sell software, the sort of thing we're doing will probably be a great boost for Prestel."

Sinclair seems confident that Prestel will at last make the long-predicted breakthrough, if only because he expects hundreds of thousands to buy Spectrums and Modems. "We won't get our fingers burnt at all because we're simply offering a facility." Sinclair believes that the size of this market may encourage others to set up their own databases: "Other companies will set them up — we're talking to them about it now."

Electronic mail may also extend the useful life of the ZX Printer, "From time to time you need hard copy either for electronic mail or for the data you're taking from the Post Office viewdata system. That's where our printer becomes so important."

He rejects criticisms that the print-out on narrow aluminised paper is unsatisfactory: "We're not replacing it at all because that printer has the unique ability to do graphics very rapidly, to print out a complete screen of data in 12 seconds. No other machine can do that at anything remotely like the price."

Those who want typewriter quality print-outs will have to wait another year for a solution from Sinclair but, in the meantime, next month's release of the Sinclair RS-232 interface will make it easier to find a compatible printer.

"We are developing a plain-paper printer — not before the end of next year — but that's a full-size printer for letters, stationery, invoices, and things like that."

Sinclair is also working on a desk-top executive machine for ICL which will incorporate many of the same ideas. "A couple of Microdrives, 7in. or 9 in. flat screen, an enhanced version of our Basic, and a telephone which links in." Inside the ICL will be an expanded Spectrum and the machines could be networked together or communicate over the telephone.

"It will replace the paper that moves around at the moment An executive can send data to anyone

'That's what a telephone is going to look like'

else in the net, receive messages on it, and his mail will come through there. It will be arranged so that somebody who doesn't know anything about computers can use it — just get a menu up on screen and select. The price will be pretty modest because we have the best technology — otherwise ICL wouldn't be coming to us."

Tony Baden of Bug-Byte believes that every home will have a home computer by the end of next year — Sinclair is slightly more cautious: "We can't make them that fast, but there will be millions, because" he points to an artist's impression of the ICL machine "that's what a telephone is going to look like one of these days. Very few will sit down to program them but people will need the facilities, like electronic mail, that it offers."

Among the other facilities Sinclair expects to offer by 1984 are expert systems giving individual tuition to children and medical advice to the family. Could the Spectrum be adapted to do this? "Perhaps the Spectrum — certainly son of Spectrum. I think the home doctor is the application we'll tackle first — that's the vital one. We'll get to the point where we have expert systems linked into teaching, offering infinite patience and infinite attention."

Cynics might suspect that a government might use this as an excuse to do away with the health and education services but Sinclair prefers to believe that "It will enable us to make better use of a scarce resource."

Sinclair is optimistic about our electronic future although he acknowledges that millions more will be thrown out of work by the new technology. "Computers are not going to suddenly and radically change our lives — they'll gradually improve them. The only way in which there can be new jobs is by hundreds of thousands of people starting different sorts of businesses — in the service industries, in new technology and in the life sciences."

Sinclair believes that the writing is on the wall for the big corporations. Small businesses "will replace the megalithic companies — the vast employers of people." Ironically his own computers are made by Timex, an American-owned multi-national.

He believes that the information revolution could lead us into a new Golden Age of civilisation rivalling Augustinian Rome, Louis XIV's France or Elizabethan England. Hopefully life for the majority of people would not be as miserable in Clive's Golden Age as it was in the societies he admires.

Renaissance prince he may be, but Sinclair resisted the temptation to be photographed next to an imitation

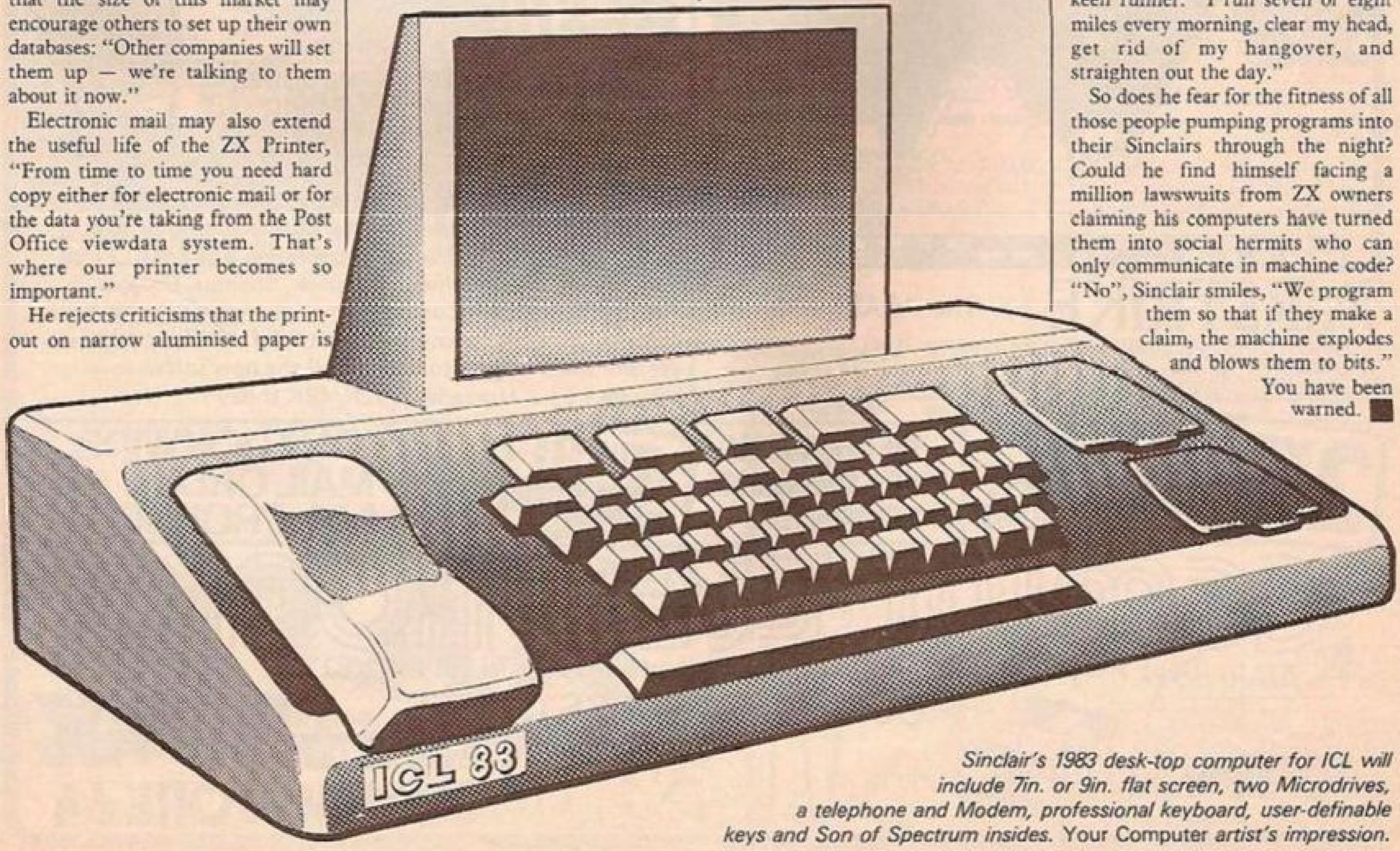
'Enable us to make better use of a scarce resource'

Greek statue on the balcony of his Chelsea service flat. "No, it's a horrible thing".

In such spare time as he has Sinclair is chairman of British Mensa, an organisation for people with high IQs. He laughs at the idea that there is anything sinister about the head of the world's largest home-computer firm also being head of Mensa.

Contrary to popular belief Clive Sinclair does not have square eyes with little white squares in the bottom left-hand corners. He is a keen runner: "I run seven or eight miles every morning, clear my head, get rid of my hangover, and straighten out the day."

So does he fear for the fitness of all those people pumping programs into their Sinclairs through the night? Could he find himself facing a million lawswuits from ZX owners claiming his computers have turned them into social hermits who can only communicate in machine code? "No", Sinclair smiles, "We program them so that if they make a claim, the machine explodes and blows them to bits." You have been warned. ■



Sinclair's 1983 desk-top computer for ICL will include 7in. or 9in. flat screen, two Microdrives, a telephone and Modem, professional keyboard, user-definable keys and Son of Spectrum insides. Your Computer *artist's impression.*

Access

GEORGE'S

VISA

BOOKSELLERS SINCE 1847

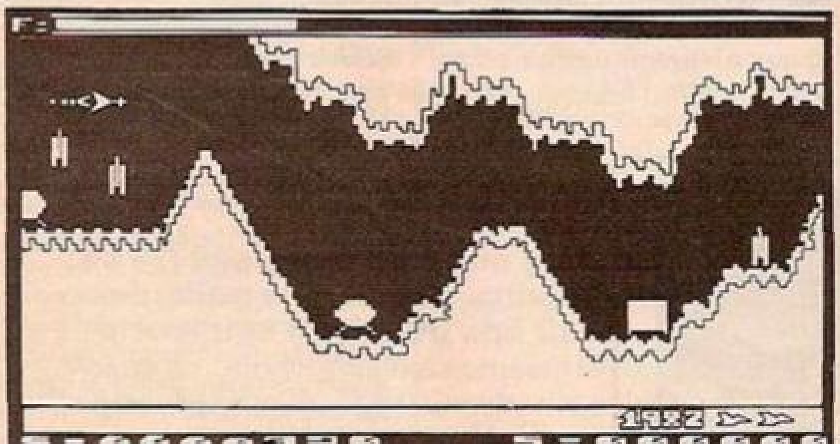
COMPUTER BOOK DEPARTMENT
81 PARK STREET, BRISTOL BS1 5PF

(Telephone: 0272 276602, extension 42 — ask for Jean Young)

A BOOKSHOP ADVERTISING IN A COMPUTER MAGAZINE? NOT SO STRANGE WHEN YOU KNOW OF THE SERVICE WE PROVIDE FOR COMPUTER USERS!

A stock of about 600 computer book titles on all aspects of computers and computing at all levels.
A comprehensive catalogue (price of £2.00 plus post and packing) containing approximately 3,700 titles, any of which can be ordered.
Software for a variety of computers, including **the BBC's own software.**
Computer magazines.

YOU ARE ALWAYS WELCOME IN A BOOKSHOP



©AIRSTRIKE For The ATARI 400/800

• INTRODUCING THE NEW ARCADE GAME FOR ATARI COMPUTERS! • SUPERB SCROLLING GRAPHICS WITH DAZZLING COLOURS! • 100% MACHINE CODE PROGRAMME FOR ONE OR TWO PLAYERS! • MULTIPLE SKILL LEVELS — FIGHT YOUR WAY THROUGH CAVERNS AND TUNNELS WITH ATTACKING MISSILES FUEL AND AMMO DUMPS TO CONTEND WITH! • AVAILABLE NOW: 16K CASSETTE / 32K DISK **£19.95** Plus 50p P & P

WE STOCK ATARI 400/800 COMPUTERS. COMMODORE VIC, 64 & MAX COMPUTERS. CALL FOR BEST PRICES!

WE STOCK ALL ATARI, ACTIVISION, PARKER, APOLLO, IMAGIC & MATTEL CARTRIDGES. CALL FOR BEST PRICES!

WE STOCK COMMODORE MAX/64/VIC SOFTWARE CALL FOR BEST PRICES!

WE STOCK LOTS AND LOTS OF ATARI SOFTWARE. E.g. Time Warp, Nautilus, Jumbo Jet Pilot, Apple Panic, Centipede, Venus Voyager, Slime, Intruder, Alien Swarm, Preppie, Pacman, Mathpack, Shamus, Frogger, Soccer!, Submarine Commander — plus many, many more titles — Call now for our latest batch of detailed brochures! We will keep you up to date on all the new software releases!!! — Upgrade to 32K/48K today!

2 YEAR GUARANTEE ON ATARI COMPUTERS | **WE SERVICE ALL ATARI & COMMODORE COMPUTERS** | **ATARI INDEPENDENT SERVICE CENTRE**

FAST NATIONWIDE MAIL ORDER ON ALL PRODUCTS.

GEMINI ELECTRONICS

ATARI Dept Y.C., 50 Newton St., Off Piccadilly, Manchester M1 2EA. Tel: 061-236 3083.



✱ COMPUTER CHESS GAMES

VIC-20 INTELLIVISION COMMODORE MAX COMMODORE 64

Can you stay on the road? Dirk Lampe's Vic-20 program tests your skills to the limit.

THIS PROGRAM is similar to the popular arcade game Nightdriver. The aim is to steer a racing car along an intricately winding road in the dark. But this program also tries to increase the competition by allowing more than one driver to compete in the race. Each driver races after the previous one has completed the course, the winner eventually being the one to finish in the fastest time.

This program was written on a Vic-20 expanded by 3K, and occupies about 4,300 bytes, but it can be squeezed into an unexpanded Vic with some rearrangement. Machine-code subroutines are Poked into memory locations near the top of the Vic's RAM at locations 6000, 6100, 6200 and 6300 in lines 10 to 190. The first subroutine draws the left side of the road, and the second the right side. The third and fourth erase the left and right sides of the road respectively.

These machine-code programs are accessed in lines 1000 to 1030 using the Vic Basic SYS command which is similar to USR on many other versions. The data is stored in locations zero and one of memory and calculated in lines 1040 to 1250.

The rest of the program — all written in Basic — starts at line 190. Lines 190 to 193 ask whether instructions are needed, and wait for the operator to press either Y or N. If Y is pressed, it then jumps to the subroutine from 2200 to 2280 which displays the instructions on the screen. As can be seen from the instructions, either a joystick or the keyboard can be used to control your car and the routine to read the joystick is situated at line numbers 2000 to 2040. In order to read the joystick the keyboard must be temporarily disabled by Poke 37154,127. It is important that you re-enable the keyboard with a Poke 37154,255 in line 2040.

Lines 200 to 301 deal with the preparations for the program and set up certain parameters like screen colour, auto-repeat on all keys, keyboard-buffer length as well as disabling the character-set switching ability, setting the position of the character set in memory and also turning off any superfluous sound.

Location 36867 controls the number of rows on the Vic screen and line 210 sets this to 46 over 2, that is 23.

Lines 220 to 260 draw a colourful title on the screen. Lines 270 to 301 then ask for the required skill level: the lower this is, the harder it is to negotiate corners; the higher, the easier. Desired course length and number of players are also requested at the same time.

The race then starts at line 305, a loop in which eight plus-signs are Poked on to the screen at line 380, representing the car bonnet. Lines 390 to 440 then move the road according to the car's movement. The keyboard buffer is scanned and the joystick read while line 450 halts the program for a time dependent on the speed of the car — top speed 255 km/h. Lines 460 to 470 produce the sound of the car engine and 480 increases the distance travelled. If you drive for one hour at 60 km/h you will, unsurprisingly, cover a total distance of 60km.

Line 530 checks if you are driving off the road. If you are, it jumps to the subroutine making you move further off the road for a random number of times. If you are not driving off the road, line 540 decides whether the road ahead should be left-curved, right-curved or straight. Line 550 checks to see if you have crashed by looking to see whether the plus-signs have been erased by the road. If they have, it makes an explosion. From there to line 600 the program returns back to line 375 unless the finishing line has been crossed or the car crashed more than five times.

In this case, the program moves to lines 3000 to the End. In this, the driver's time is displayed. If there are still more contenders, it then returns to the start of the race track for the next driver. If the driver was the last contender, the competitors' results are once again displayed.

To fit the program into an unexpanded Vic's memory, first write lines 10 to 100 leaving out all the Rem statements. Then change the Poke addresses as shown.

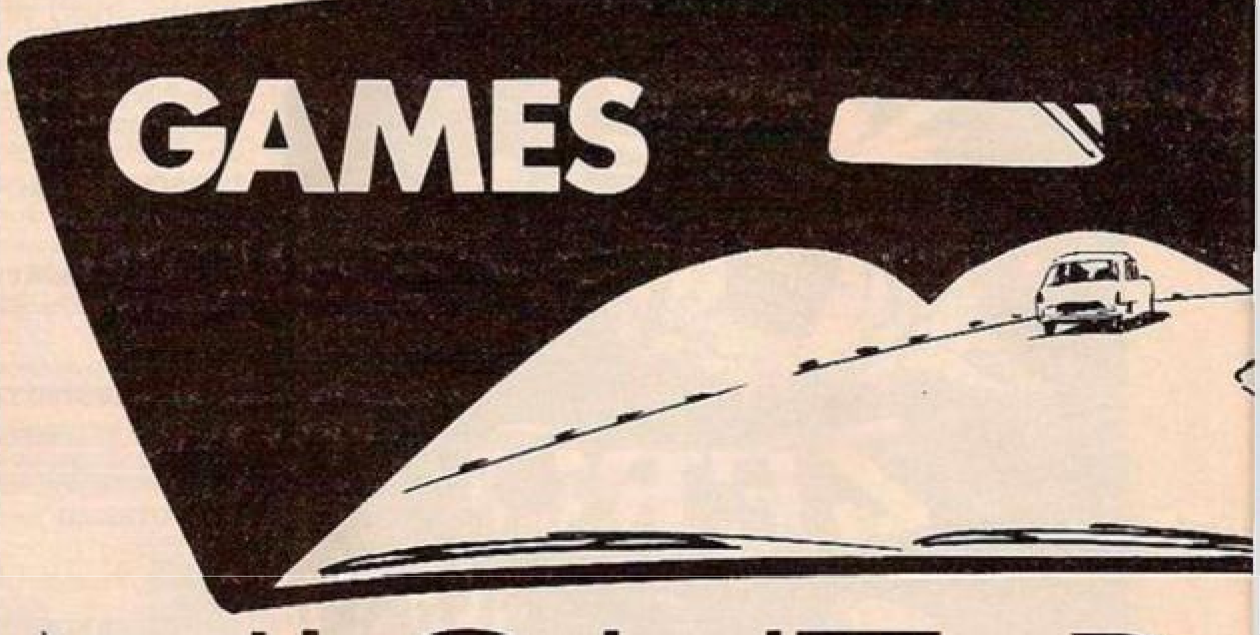
Line	New address
10	6800 + S
40	6830 + S
60	6860 + S
90	6890 + S

Change the last few items in the Data statements of the following lines to the new numbers given — in each case, the numbers to be changed are those following the number 76.

Line	Old	New
30	112,23,£	144,26,£
50	212,23,£	174,26,£
80	56,24,£	204,26,£
100	156,24,£	234,26,£

Next, Save the program on tape, then write the rest of the program as listed, leaving out the following sections and any Rem statements that might turn up: lines 101-260 inclusive, and lines 1999-2280.

In line 390 delete the Gosub 2000; in lines 1000-1030 change the SYS addresses to 6800, 6830, 6860, 6890 respectively, from what they



NIGHT RA

```
7 REM MACHINE CODE TO
8 REM DRAW ROAD.
9 REM
10 READA$:IFA$<>"#"THENPOKE6000+S,VAL(A$):S=S+1:GOTO10
11 M=RND(-TI)
20 DATA24,165,0,233,22,176,1,96,24
30 DATA169,78,160,0,145,0,165,0,233,20,133,0,76,112,23,#
35 S=0
40 READA$:IFA$<>"#"THENPOKE6100+S,VAL(A$):S=S+1:GOTO40
50 DATA24,165,0,233,22,176,1,96,24,169,77,160,0,145,0,165,0,233,22,133,0,76,212
,23,#
55 S=0
56 REM ************
57 REM MACHINE CODE
58 REM ERASE ROAD.
60 READA$:IFA$<>"#"THENPOKE6200+S,VAL(A$):S=S+1:GOTO60
70 DATA24,165,0,233,22,176,1,96,24
80 DATA169,32,160,0,145,0,165,0,233,20,133,0,76,56,24,#
85 S=0
90 READA$:IFA$<>"#"THENPOKE6300+S,VAL(A$):S=S+1:GOTO90
100 DATA24,165,0,233,22,176,1,96,24,169,32,160,0,145,0,165,0,233,22,133,0,76,15
6,24,#
110 REM
120 REM ADDRESSES :
130 REM DRW LEFT 6000
140 REM DRW RIGHT 6100
150 REM ERS LEFT 6200
160 REM ERS RIGHT 6300
170 REM
180 REM
190 REM THE BASIC
191 PRINT"]INSTRUCTIONS?"
```

were previously — 6000, 6100, 6200, 6300 — and in line 260 type Poke 650,128. Now, Save the program after the first part.

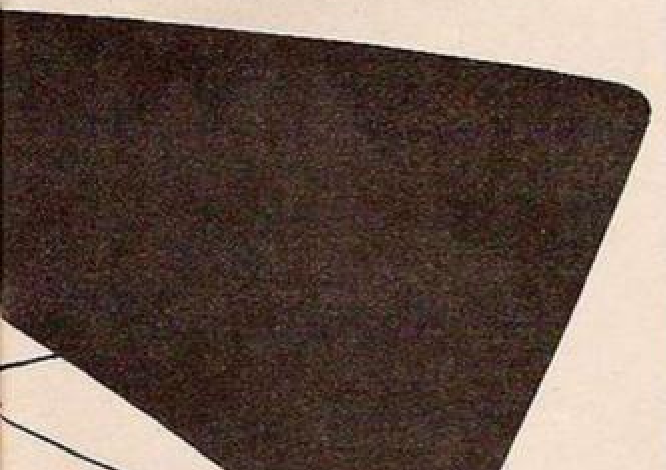
The loading procedure for the unexpanded Vic program is as follows: wind the tape to wherever the first program is stored and then type Load, and when the program has loaded, Run followed by New and Load again. The game is then loaded.

This an an assembled version of the machine-language subroutine starting at 6000 (or 6800):

```
CLC             LDY#0
LDA 0           STA (0),Y
SBC#22          SBC#22
BCS 1           STA 0
RTS             JMP 6000 or 6800
CLC             on the unexpanded Vic.
LDA#78
```

A joystick cannot be used on an unexpanded Vic.

The other machine-code subroutines are almost identical. All are written in 6502 machine code. ■



ACER

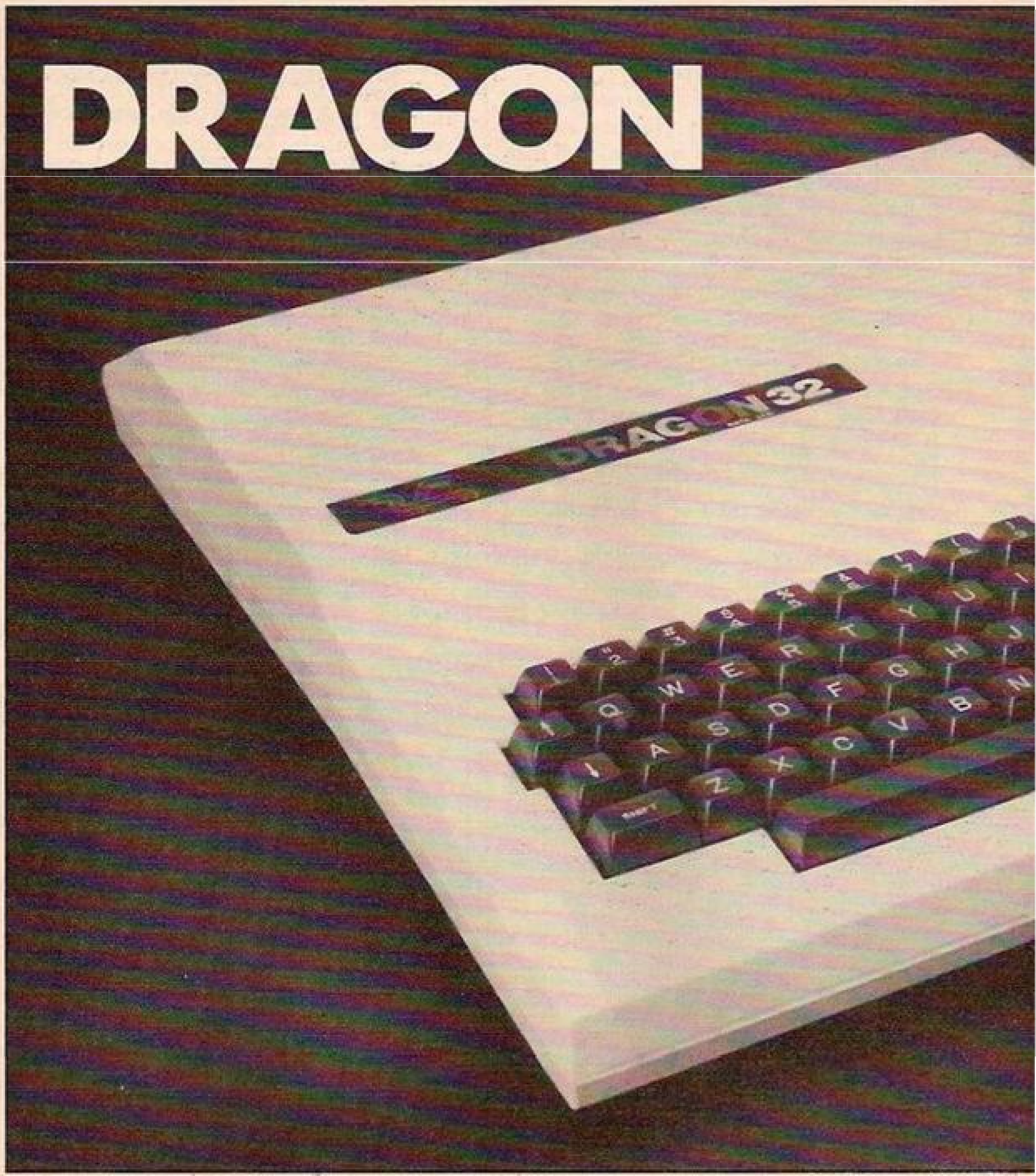
Vic-20 addresses.

- 1024-7679 RAM, for programs, on expanded Vic
- 4096-7679 on unexpanded
- 7680-8185 screen memory
- 36879 screen/border colours
- 36878 volume of sound
- 36874-36877 sound speaker channels, value >128 and sound emits from appropriate speaker.
- 650 key repeat (>128 and all keys repeat)
- 649 length of keyboard buffer
- 657 disable switching keys
- 36869 location of character generator in memory, if 240 then in ROM 32768
- 0,1 zero page RAM — usually not used by Vic's OS
- 36867 rows on Vic screen (×2)
- 37152, 37137, 37154 Vic user port for joystick

The above addresses in the Vic would need to be changed for conversion to other systems.

```
192 GETA$:IFA$<>"N"ANDA$<>"Y"THEN192
193 IFA$="Y"THENGOSUB2200
200 POKE36879,31:POKE650,128:POKE657,128:POKE649,1:POKE36869,240:POKE36874,0:PO
KE36875,0
210 POKE36867,PEEK(36867)AND129OR(46):POKE36876,0:POKE36877,0:POKE36878,0
220 PRINT"■■■                              NIGHTDRIVER
"
230 FORI=7680TO7701:POKEI,160:POKEI+30720,IAND7:NEXT
240 FORI=7789TO7768STEP-1:POKEI,160:POKEI+30720,IAND7:NEXT
250 FORI=8164TO8185:POKEI,160:POKEI+30720,(I-1)AND7:NEXT
260 PRINT:PRINT"WRITTEN BY ■DIRK LAMPE■.":PRINT
270 INPUT"LEVEL OF PLAY";LE:IFLE<>INT(LE)ORLE<>ABS(LE)ORLE<1THEN270
280 LE=LE+1
290 INPUT"COURSE LENGTH";CL:IFCL<>INT(CL)ORCL<>ABS(CL)THEN290
300 INPUT"NO OF PLAYERS";PL:IFPL<>INT(PL)ORPL<>ABS(PL)ORPL<1THEN300
301 DIMTT(PL),TT$(PL)
305 FORQ=1TOPL
310 FORI=1TO1000:NEXT
320 PRINT"■■■*****NIGHT DRIVER*****":PRINT"■■■■■■■■■■                    ";
330 PRINT"SPEED    :               DISTANCE:              CAR NO  :         ";
340 PRINT"PLAYER   :"Q"■                 ":POKE36879,11:POKE36867,PEEK(36867)AND129OR(
32)
350 L=0:SP=10:CH=1:DS=0:R=0:RR=7921:RL=7900:TS=0
360 GOSUB1000
370 GOSUB1010:X=TI:Y=TI
375 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■"SP"■":PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■"INT(DS)"
■"
376 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■"CH"■"
380 FORI=7907TO7914:POKEI,43:NEXT
390 FORI=1TOLE:GETA$:GOSUB2000:IFA$="G"ORA$="T"THENI=LE:GOTO420
400 IFA$="F"THENGOSUB1040
410 IFA$="H"THENGOSUB1200
420 NEXT:IFA$<>"G"ANDA$<>"T"THEN445
430 IFA$="G"ANDSP<255THENSP=SP+1
440 IFA$="T"ANDSP>0THENSP=SP-1:PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■        ";:PRINT"■■■
■"SP"
445 IFSP=0THEN375
450 FORI=1TO64*4-1-SP:NEXT
460 SS=(SPAND63)+128+INT((SP+64)/64)*10
470 POKE36874,SS:POKE36875,SS:POKE36876,SS:POKE36877,SS:POKE36878,15
480 DS=DS+((TI-X)/216)*SP
490 IFR<>0ANDR<>1THEN530
500 T=RND(1):IFT<.1THENGOSUB1040:GOTO550
510 IFT<.2THENGOSUB1200
520 GOTO550
530 IFR>0ANDRND(1)<.95THENGOSUB1200:IFRND(1)>.8THEN530
535 IFR>0THEN550
540 IFRND(1)<.95THENGOSUB1040:IFRND(1)>.8THEN540
550 A=0:FORI=7907TO7914:IFPEEK(I)<>43ANDPEEK(I)<>32THENA=9:I=7914
560 NEXT:IFA<>9THEN590
570 POKE36874,0:POKE36875,0:POKE36876,0:POKE36877,128:FORI=15TO0STEP-1:POKE3687
8,I
580 FORJ=1TO500:NEXT:NEXT:CN=CN+1:IFCN>5THENTT$(Q)="C":GOTO3000
590 IFDS>=CLTHEN3000
595 IFSP>TSTHENTS=SP
600 X=TI:GOTO375
999 GOTO999
1000 POKE0,RL-INT(RL/256)*256:POKE1,INT(RL/256):SYS6000:RETURN
1010 POKE0,RR-INT(RR/256)*256:POKE1,INT(RR/256):SYS6100:RETURN
1020 POKE0,RL-INT(RL/256)*256:POKE1,INT(RL/256):SYS6200:RETURN
1030 POKE0,RR-INT(RR/256)*256:POKE1,INT(RR/256):SYS6300:RETURN
1040 GOSUB1020:GOSUB1030
1050 IFL>=0THENL=L+1:RL=RL+1:GOTO1070
1060 IFL<0THENL=L+1:RL=RL+22
1070 IFR>0THENR=R-1:RR=RR+1:GOTO1090
1080 IFR<=0THENR=R-1:RR=RR-22
1090 GOSUB1000:GOSUB1010:RETURN
1200 GOSUB1020:GOSUB1030
1210 IFR>=0THENR=R+1:RR=RR-1:GOTO1230
1220 IFR<0THENR=R+1:RR=RR+22
1230 IFL>0THENL=L-1:RL=RL-1:GOTO1250
1240 IFL<=0THENL=L-1:RL=RL-22
1250 GOSUB1000:GOSUB1010:RETURN
1999 REM JOYSTICK
2000 IF((PEEK(37137))AND4)=0THENA$="G":RETURN
2010 IF((PEEK(37137))AND8)=0THENA$="T":RETURN
2020 IF((PEEK(37137))AND16)=0THENA$="F":RETURN
2030 POKE37154,127:IF-((PEEK(37152)AND128)=0)=1THENA$="H"
2040 POKE37154,255:RETURN
2200 PRINT"■INSTRUCTIONS"
2210 PRINT:PRINT"F=LEFT"
2220 PRINT"H=RIGHT"
2230 PRINT"T=DECELERATE"
2240 PRINT"G=ACCELERATE"
2250 PRINT:PRINT"OR USE JOYSTICK"
2260 PRINT:PRINT"HIT A KEY"
2270 GETA$:IFA$=""THEN2270
2280 RETURN
3000 POKE36874,0:POKE36875,0:POKE36876,0:POKE36877,0:POKE36867,PEEK(36867)AND12
9OR(46)
3010 POKE36879,25:Y=TI-Y:TT(Q)=Y
3020 PRINT"■■PLAYER"Q":":IFTT$(Q)="C"THENPRINT"CRASHED......":GOTO3050
3030 PRINT"CROSSED THE FINISH":PRINT"LINE IN A TIME OF":PRINT"■"INT(Y/60)"SECS"
:PRINT
3040 PRINT"TOP SPEED:"TS"KM/H"
3050 FORI=1TO4000:NEXT:NEXT
3060 PRINT"■THE RESULTS :":PRINT
3070 FORI=1TOPL:PRINT"PLAYER"I":";
3080 IFTT$(I)="C"THENPRINT" CRASHED":GOTO3100
3090 PRINTINT(TT(I)/60)"SECS"
3100 NEXT:PRINT:PRINT
3110 IFPL=1THEN3160
3120 PRINT"THE WINNER :":PRINT:A=0
3125 FORI=1TOPL
3126 IFTT$(I)<>"C"THENA=I:I=PL
3127 NEXT:IFA=0THENA=PL
3130 FORI=1TOPL:IFTT$(I)="C"THEN3150
3140 IFTT(I)<TT(A)THENA=I
3150 NEXT:IFTT$(A)<>"C"THENPRINT"PLAYER"A
3155 IFTT$(A)="C"THENPRINT"NOBODY."
3160 PRINT:PRINT"■HIT A KEY.":FORI=1TO10:GETA$:NEXT
3170 GETA$:IFA$=""THEN3170
3180 CLR:GOTO200
```

DRAGON



The high-resolution graphics capabilities of the Dragon 32 are excellent, but the manual suggests that the best way to produce a picture on the screen is to resort to a pencil and a high-resolution grid. The standard graphics commands and the manual give you a high degree of control over drawing high-resolution pictures but need to be planned carefully. Keith and Steven Brain's drawing program allows you to take advantage of the Dragon's best graphics features while giving you the freedom of a true artist of the electronic screen. With the program you can paint and fill in areas of the screen as your creative drive demands.

PURISTS WILL ALWAYS insist that programs should be written away from the keyboard. The more spontaneous among us find direct drawing on to the screen preferable. This article deals with some of the difficulties which have to be tackled to enable this on the Dragon.

Curves and colour

The first problem encountered is the inability to Print on the high-resolution screen or to make inputs in high-resolution mode, but fortunately these problems can be overcome via the Inkey$ function. Although the Line and Circle commands require specification of start and end co-ordinates, the Draw command is much more lenient and is easily accessed via Inkey$.

The default value for any of the standard draw commands, Up, Down, Right, Left, E, F, G, and H Diagonal is one scale unit. Therefore these can be called by a single Inkey$ character, to give a single scale to be achieved by the following simple subroutine:

```
20 A$ = INKEY$
30 IF INKEY$ = "" THEN 20
100 DRAW A$
```

Curves can be constructed by judicious use of these keys at the minimum Scale setting.

The fundamental Scale unit must be defined at the start of the program, together with the PMode and Screen type, but Scale can also be varied during execution by means of the S key and evaluation of A$. Depression of this key can be made to increase the value of the Scale unit thus:

```
10 PMODE = 3,1: SCREEN = 1,0: S = 4
40 IF INKEY$ = "S" THEN S = S + 2
50 DRAW "S" + STR$(S)
```

Another key can be used to reduce or reset the Scale to the original value and thus one key gives a wide range of Scale factors.

Colour can be reached similarly by checking if the Inkey$ function is a numeral whose Val can be used to set the subsequent Draw colour, by examining the ASCII value in the new line 100.

```
60 A = ASC(A$)
100 IF A>47 AND A<57 THEN C$ = A$
    ELSE DRAW A$
```

Blank moves can be made by Drawing in the background colour, and these moves can also be used to erase unwanted parts of the picture. Any permitted Colour for the selected PMode can be called.

To aid composition, a flashing cursor can be provided to indicate the current Draw position. It does this by rapidly Drawing in a visible Colour and then Drawing in the reverse direction in the background Colour.

```
30 IF A$ = "" THEN DRAW
   "S1C1R1COL1": GOTO 30
```

Further assistance can be provided via the Sound function. An audible feedback can be provided for each type of key depression: different tones can be constructed around middle C — 89 — from the ASC value of the Inkey$ string.

```
110 SOUND (89 + ASC(A$)), 2: GOTO 30
```

For the final touch, more colour can be added to the screen via Paint. This is reached through P, returning the screen to low-resolution and requesting the co-ordinates and colour information to be added. As the high-resolution screen is not cleared, return from this subroutine to high-resolution reveals Painting in progress, and further Drawing can also take place.

```
70 IF A$ = "P" THEN GOTO 200
```

Figure 2.

```
10 CLS0
20 X=RND(7):Y=X*16:Z=143
+Y
30 N=RND(510):PRINT@(N),
CHR$(Z);
40 A=255-INT(N/2):IFA=0T
HENA=1
50 SOUNDA,1:GOTO20
```




```
200 CLS: PRINT "PAINT COORDINATES";:
    INPUT P1, P2: PRINT "PAINT COLOUR";:
    INPUTPC:PRINT"BORDER COLOUR";:
    INPUT BC
210 PMODE 3,1: SCREEN 1,0: PAINT (P1,
    P2), PC, BC: GOTO 70
```

Having composed a masterpiece worthy of Rembrandt or Picasso, one obviously would like to retain this for posterity.

Although the Get command allows storage of screen information in an array, it cannot be used to store the entire screen due to memory limitations. Each screen would require the setting up of an array of 256 * 192 units — more than 48K. A more conservative alternative was suggested by examination of the Dragon memory map which revealed that the first four Pages of high-resolution RAM lie between 1536 and 7679. A subroutine which Peeks the values in these locations and Loads them into an array can therefore store the same information in much more compact form, about 6K.

Cut access time

For more permanent storage, this array can be put on to a cassette as a data file. Whilst this approach does work it is rather slow as a 6K-long data file takes over five minutes to load.

This problem can be easily circumvented by use of the CSaveM and CLoadM commands to Save and Load the contents of high-resolution graphics pages as a machine-code file. This reduces the access time to only 20 percent of that required for a data file and makes storage of detailed freehand pictures easy.

A complete program for real-time on-screen drawing based on these principles is given in figure 1. This is rather more complex and incorporates a number of devices to make it more user-friendly.

Program devices

Line 20 includes B$ which contains a list of all permitted keys, and X$ which lists the number of high-resolution pages for each mode. Line 30 requests the PMode and Screen parameters to be used, and sets the default Scale value to four. Line 40 uses string-slicing to set PG to the appropriate value for the number of pages required.

Line 50 sets up the high-resolution display, and moves the cursor to the top left-hand corner. Line 60 checks for instructions and, if there are none, flashes the cursor.

Line 70 uses the Instr function to check whether an incorrect key has been depressed, and if so sounds a raspberry.

Line 80 sets the Scale and Colour parameters for each movement. Line 90 checks whether an increase in Scale is required, and line 100 resets Scale to the default value.

Line 110 checks for "C" for clearing the screen. After a few accidental disasters this requires confirmation of action via the subroutine at 260 which requires an Input.

Line 120 checks for "P" and leads to the Paint subroutine at 240, which allows blocks of colour to be added. Warning: watch out for pinholes in your pictures — the paint can spill through them with disastrous results.

Line 130 leads via ↑ to the Save routine, and 140 via @ to the load routine. Both of these subroutines request a file name, and ask if the recorder is ready.

To avoid recognition of taped machine-code files when making a directory, an M is added to the selected file name. The Save routine displays that Saving is in progress, and that Saving has been completed. As the high-resolution screen is set up before activation of the CLoadM, the result is an impressive build-up of the complete picture from the top of the screen as loading progressess.

Line 150 is the default which checks if Inkey$ is a number and, if so, alters the Colour value, or Else draws U, D, L, R, E, F, G or H — all one-scale units. If background Colour is selected then obviously a blank move is achieved.

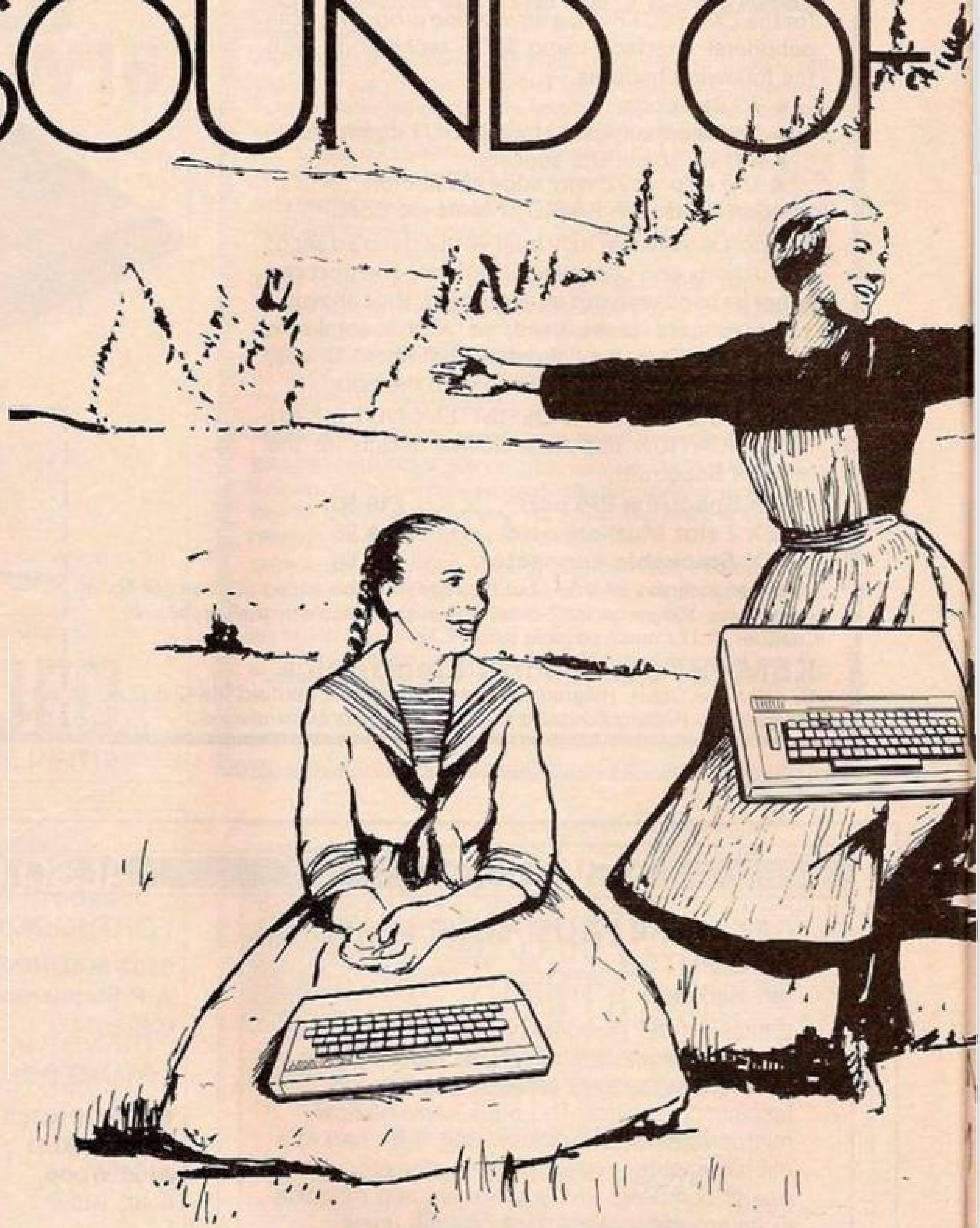
Line 160 makes a sound related to the ASCII value of Inkey$ to confirm the selected move, and returns to the keyboard-scanning mode.

Figure 2 is a simple program which builds up a display of blocks of colour on the screen. As each randomly-chosen block of colour appears in a random position on the screen, a note sounds. The notes are high if the block appears towards the top of the screen and low towards the bottom. The program is not particularly sophisticated but it does indicate how easy it can be to create a background display or conversation piece perhaps for a party. ■

Figure 1.

```
10 REMDRAGARTCOPYRIGHTK&
SBRAIN1982
20 B$="CUDLREFGHSXP01234
5678@↑":X$="12244"
30 CLS0:PRINT"MODE";:INP
UTZ:PRINT"SCREEN";:INPUT
Y:S=4
40 PG$=MID$(X$,Z+1,1):PG
=VAL(PG$)
50 PMODEZ,1:SCREEN1,Y:DR
AW"BM0,0"
60 A$=INKEY$:IFA$=""THEN
DRAW"S1C1R1C0L1":GOTO60
70 IFINSTR(1,B$,A$)=0THE
NSOUND2,5:GOTO60
80 DRAW"S"+STR$(S):DRAW"
C"+C$
90 A=ASC(A$):IFA=83THENS
=S+2:GOTO160
100 IFA=88THENS=4:GOTO16
0
110 IFA=67THEN260
120 IFA=80THEN240
130 IFA=94THEN170
140 IFA=64THEN210
150 IFA>47ANDA<57THENC$=
A$ELSEDRAWA$
155 DRAW"S"+STR$(S):DRAW
"C"+C$
160 SOUND(89+ASC(A$)),2:
GOTO60
170 CLS4:PRINT"SCREENSAV
E":GOSUB220:CLS3:PRINT@1
92,"SAVING SCREEN"
180 CSAVEMF$,1536,(1536+
(1535*PG)),(1535*PG)
190 PRINT@384,"SCREEN SA
VE":PRINT@480,"PRESS SPA
CEBAR TO CONTINUE"
200 IFINKEY$=""THEN200EL
SEGOTO20
210 CLS2:PRINT@0,"SCREEN
LOAD":GOSUB220:PMODEZ,1:
SCREEN1,Y:CLOADMF$:GOTO6
0
220 PRINT@160,"FILENAME"
;:INPUTF$:F$="M"+F$:PRIN
T@224,"WHEN TAPE READY P
RESS SPACEBAR"
230 IFINKEY$=""THEN230EL
SERETURN
240 CLS0:PRINT"PAINT CO-
ORDINATES";:INPUTP1,P2:P
RINT"PAINT COLOUR";:INPU
TPC:PRINT"BORDER COLOUR"
;:INPUTBC
250 PMODEZ,1:SCREEN1,Y:P
AINT(P1,P2),PC,BC:GOTO60
260 CLS4:PRINT"CLEAR SCR
EEN (Y/N);:INPUTD$:IFD$<
>"Y"THENGOTO50ELSEPCLS:G
OTO50
```

THE SOUND OF



The hills could be alive with the sound of your Atom if you take David Morton's advice.

MOST MICROCOMPUTERS can make noises, though sometimes their range is limited. Apart from sound effects for games this capacity has an obvious application in music production. However, if you, like me, are completely unmusical you will not have been able to make the best use of the variety of programs allowing you to compose, play and store music. Why not use the computer to compose and play short melodies?

A computer can compose tunes by basing its composition on a pattern of established music. This is done by taking a piece of music, splitting it into bars and storing them in memory. Bars can then be selected at random and joined together to form flowing music.

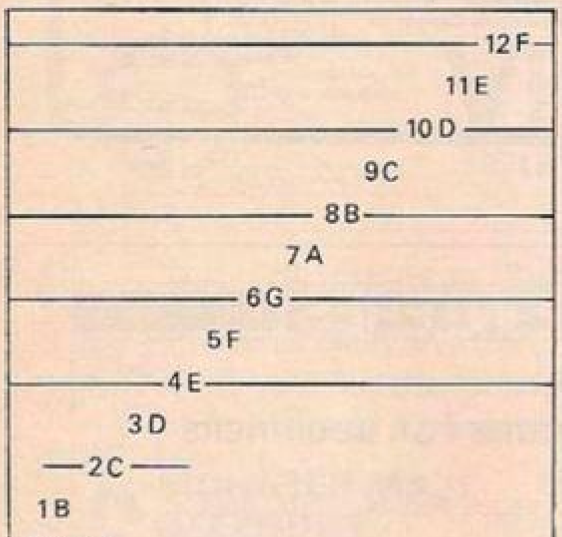


Figure 1.

The disadvantage of this method is the large amount of storage needed. Another approach is to analyse examples of a composer's work statistically, and this is the approach covered here. The programs are written for an Acorn Atom, but are easily modified for other computers with sound-generation facilities.

		1 B	2 C	3 D	4 E	5 F	6 G	7 A	8 B	9 C	10 D	11 E	12 F
1	B	29	141	56	0	0	29	0	0	0	0	0	0
2	C	13	48	36	109	24	13	0	0	12	0	0	0
3	D	35	57	46	57	12	12	24	0	0	0	12	0
4	E	0	9	59	18	51	51	25	17	25	0	0	0
5	F	0	0	0	80	16	95	24	8	0	0	0	32
6	G	11	0	16	0	37	31	69	37	26	6	22	0
7	A	0	10	10	0	33	48	25	43	48	5	5	28
8	B	10	0	5	10	23	10	75	23	75	10	14	0
9	C	0	8	0	8	8	22	16	76	45	34	12	26
10	D	0	0	0	0	0	25	34	9	93	68	9	17
11	E	0	10	0	0	0	0	0	39	49	88	49	20
12	F	0	9	0	0	0	0	26	34	42	0	68	76

Table 1. The Strauss probabilities.

It is simple to count how many times a particular note occurs, but this is not much use for composition unless the number of times a particular note follows any other note is counted. It is then possible to calculate, given a note, the probability that any other note will follow it. If a table of such probabilities is built up, a fingerprint is provided on which the computer can base its composition. This fingerprint is different for each composer.

The first program produces this table of probabilities, but requires some time to enter a substantial number of notes at the keyboard. I have therefore given the results from two runs of the program on different composers. For simplicity, and because of the limit on storage space, I have confined the analysis to 12 notes and ignored the duration of each note. The notes are entered as the numbers 1-12 representing the notes as indicated in figure 1.



Each analysis should ideally be confined to the music of one composer; a variation in style confuses the results. The program is simple. It counts the number of times any note follows any other note, building up an array of 144 elements.

		1 B	2 C	3 D	4 E	5 F	6 G	7 A	8 B	9 C	10 D	11 E	12 F
1	B	0	0	255	0	0	0	0	0	0	0	0	0
2	C	0	0	255	0	0	0	0	0	0	0	0	0
3	D	16	16	32	80	48	16	10	16	0	15	16	0
4	E	0	15	96	48	64	0	0	16	0	0	16	0
5	F	0	0	32	64	80	32	0	32	15	0	0	0
6	G	0	0	0	0	64	47	0	96	47	0	0	0
7	A	0	0	0	0	0	0	0	255	0	0	0	0
8	B	0	0	16	0	80	15	16	64	48	0	16	0
9	C	0	0	16	0	16	16	0	143	32	0	32	0
10	D	0	0	0	0	0	0	0	0	127	128	0	0
11	E	0	0	0	0	0	0	0	64	111	48	16	16
12	F	0	0	0	0	0	0	0	95	0	160	0	0

Table 2. The U.S. composer's probabilities.

On completion of the data entry, indicated by entering an 0, this array is converted to an array of probabilities in which 255 represents certainty and 0 impossibility. The two tables of probabilities below were produced from about ten melodies each, the first by Strauss and the second by an American composer.

Each table can be stored in memory as an array — although I used the Atom's byte-vectors to save space. In each table the last note to be played is represented in the extreme left column, and the probability of any note following it is represented by the members of that row. Thus, in the first example, the probability that the note C2 follows B1 is 141/255 and it is impossible for the note C9 to follow B1.

The second program uses the second table of probabilities to decide on a series of notes, playing and drawing them as it does so.

A range of notes

In this program, the subroutine between lines 330 and 350 decides on the next note to be played by choosing a random number between 1 and 255, and then looking along the appropriate row of the table. The members of that row are added together until the sum is greater than the random number. The note whose probability was last added to the sum is chosen as the new note, which is played and drawn on the screen.

The Atom's speaker is connected to Bit 2 of an output port and a tone is produced by Exclusive-Oring the port with 4. The speed at which this is done determines the frequency of the tone produced. The assembler routine at line 80 does this; it is an exact copy of the one from the Atom's manual.

The frequency is determined by the contents of the accumulator and the duration of the note by the Y-register. These are calculated by Basic before entering the machine-code routine at line 310.

The numbers representing the frequency of each note are stored in another array, and are calculated from the fact that the time between successive blips of the speaker is 5*x+17 cycles, which at 1 MHz is $(5*x+17)*10^{-6}$ seconds. The value of x can therefore be easily found. The frequencies I used are listed below and are based on a middle C of 262 Hz.

Note	Frequency Hz	x
B	988	199
C	1047	188
D	1174	167
E	1319	148
F	1397	140
G	1568	124
A	1760	110
B	1976	98
C	2093	92
D	2344	82
E	2637	72
F	2794	68

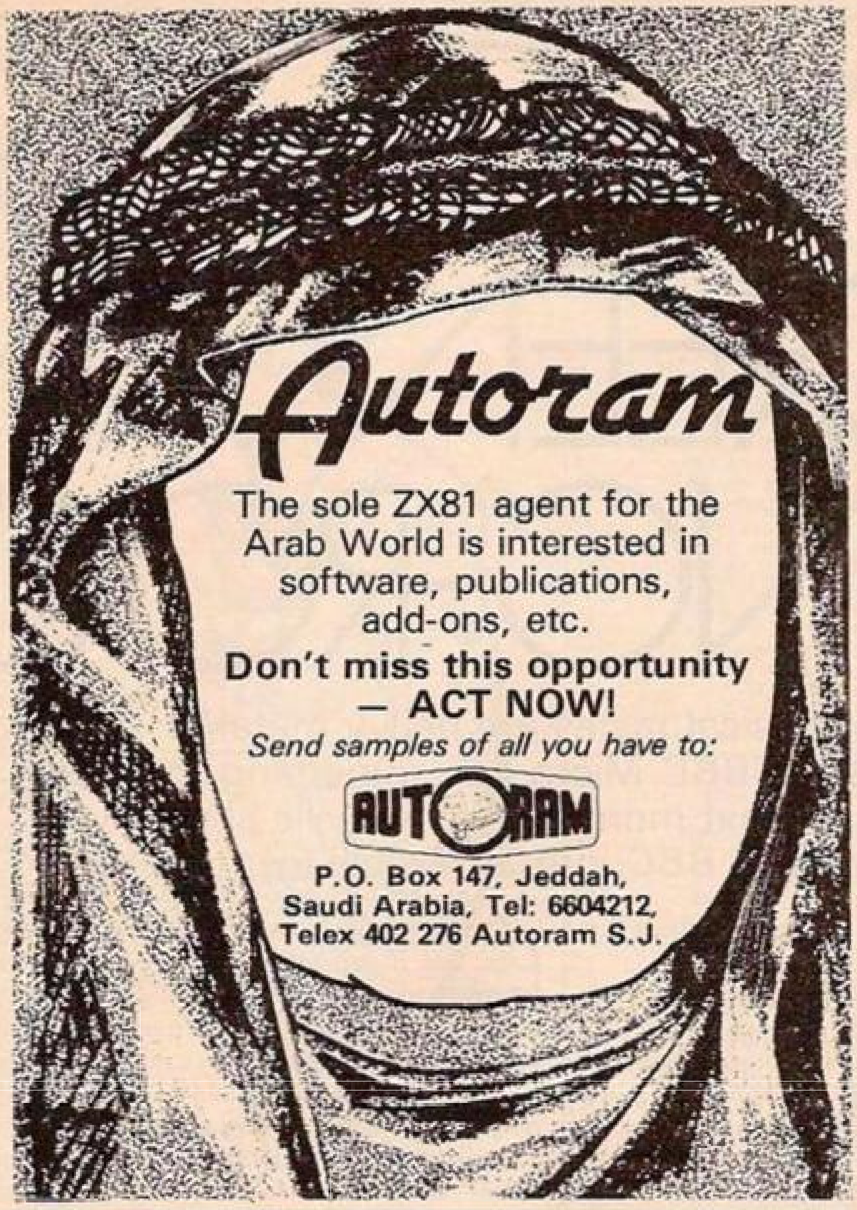
The music produced by this program, although far from random, tends to lose structure over a long period of time. There is some scope for improvement. For example, it is possible to analyse three or more note sequences instead of two, or to take account of the length of notes. Much better results are obtained when a programmable sound generator, like the AY 38910, is used.

(continued on next page)

(continued from previous page)

```
   10 P.$12'"   *****music analy
ser*****"'''
   20 P." THIS PROGRAM WILL CREA
TE A     TABLE IN WHICH "
   30 P."THE PROB. OF ANY NOTE F
OLLOWING ANY OTHER NOTE ISGIVEN.
"
   40 P.''" PLEASE ENTER NOTES A
S THE       NUMBERS 1-12."''''
   50 P."press a key";LI.#FFE3
   60 P.$12
   70 W=#2800;F.N=0TO144;W?N=0;N

   80 REM INPUT NOTES
   90 O=8;DO
  100 IN.N;IF N<0OR N>12;G.100
  110 P=(O-1)*12+N-1
  120 W?P=W?P+1
  130 O=N
  140 U.N=0
  150 REM CREATE PROBS.
  160 F.X=0TO144S.12;S=0
  170 F.Y=X TO(X+11)
  180 S=S+W?Y;N.
  190 IF S=0;S=1
  200 F.Y=X TO(X+11)
  210 W?Y=W?Y*255/S
  220 N.;N.
  230 P.'"TABLE OF PROBS IS STOR
ED IN W?0 TO W?143."'
  240 END
   10 P.$12'"       *******COMPOS
ER*******"
   20 P.'"  THIS PROGRAMME COMPO
SES TUNES."
   30 P."THE ATOM IS GIVEN THE"'
"PROBABILITY"
   40 P." THAT ANY NOTE WILL  FO
LLOW ANY OTHER NOTE."
   50 !#71=#85FFE320;!#75=#6070
   60 DIM F12,WW4,W144,P-1
   70 P.$21
   80[:WW0 STA #80;LDA@0
   90:WW2 LDX#80
  100:WW1 DEX;BNE WW1
  110 EOR@4;STA#B002
  120 DEY;BNE WW2;RTS;]
  130 P.$6
  140 F?0=199;F?1=188;F?2=167;F?
3=148;F?4=140;F?5=124
  150 F?6=110;F?7=98;F?8=92;F?9=
82;F?10=72;F?11=68
  160 F.X=0TO144;W?X=0;N.
  170 W?2=255;W?14=255;W?24=16;W
?25=16;W?26=32;W?27=80;W?28=48
  180 W?29=16;W?31=15;W?33=16;W?
34=16;W?37=15;W?38=96;W?39=48
  190 W?40=64;W?43=16;W?46=16;W?
50=32;W?51=64;W?52=80;W?53=32
  200 W?55=32;W?56=15;W?64=64;W?
65=47;W?67=96;W?68=47;W?79=255
  210 W?86=16;W?88=80;W?89=15;W?
90=16;W?91=64;W?92=48;W?94=16
  220 W?98=16;W?100=16;W?101=16;
W?103=143;W?104=32;W?106=32
  230 W?116=127;W?118=128;W?127=
64;W?128=111;W?129=48;W?130=16
  240 W?131=16;W?139=95;W?141=16
0
  250 N=A.R.%12
  260 P.''" NOTE LENGTH ?";LI.#7
1;A=(?#70-47)*2
  270 GOS.b
  280 DO
  290 D=(50+A.R.%A)*256
  300 A=F?N;Y=D/A
  310 LI.WW0
  320 GOS.a;GOS.c;U.?#B001<>#FF;
P.$12;G.260
  330aREM NEXT NOTE
  340 Y=A.R.%254+1;G=0;M=N*12
  350 DO;G=G+(W?M);M=M+1;U.G>=Y;
N=M-(N*12)-1;R.
  360bREM DRAW NOTE
  370 CLEAR4;F.K=163TO85.-30;F.J
=1TO20S.4
  380 MOVE2,(K+J);PLOT1,250,0;N.
;N.;U=0;V=157;R.
  390cU=U+8;Q=N
  400 MOVE U,(V+Q*2);PLOT1,-2,0;
PLOT1,0,2;PLOT1,2,0;PLOT1,0,-2
  410 PLOT1,-1,1;PLOT1,1,1
  420 IF Q>6PLOT0,-2,-2;PLOT1,0,
-7;G.d
  430 PLOT1,0,7
  440dIF U%248=0U=0;V=V-30;IF V<
0GOS.b
  450 R.
```



★★ **NEW FROM CAMEL PRODUCTS** ★★

AN INNOVATIVE PRODUCT

FOR YOUR ZX81

Faster than a Floppy

Easier than an EPROM

MEMIC-81

HOW IT WORKS & WHAT IT DOES

This useful accessory for ZX81 users is a 2 kilobyte (or 4KB) memory module using chips fabricated in a remarkable technology. When not actually in use, these CMOS chips can be put into standby. They then take only a minute current to retain the data securely. The Lithium battery fitted in the unit will last for 5 to 10 years. Plug it into the ZX81 and flick a switch and the data is ready for retrieval.

MEMIC-81 resides in the 8-12K area of ZX81's memory map. This area is not directly addressed by Basic, but Basic programs can easily be stored and retrieved by means of the tiny 12 byte routine provided. This can itself be stored in CMOS, so that Basic programs become available simply by entering PRINT USR . . . Machine Code routines are directly accessible.

Clear User Notes, Application Notes, Program Example and the necessary routines are provided with MEMIC-81, which comes cased and with an extender card at the back.

For a picture of MEMIC-81, see Sept Y.C. page 122.

2kB MEMIC-81 £24.95 + VAT   4kB MEMIC-81 £29.95 + VAT

OTHER CAMEL PRODUCTS

MEMIC T	2 kB Towerblock version for any System	£29.95 incl.
MEMIC L	2 kB Low Profile version with cabled connector	£29.95 incl.
PIO-81	8+8 Ch. latched Input/Output ZX81 card	£13.00 + VAT
ROM-81	2 kB-8 kB ROM/EPROM Unit for ZX81	£14.95 + VAT

Cambridge Microelectronics Ltd, One Milton Rd., Cambridge, CB4 1UY Tel (0223) 314 814

THE BBC MICROCOMPUTER SPECIALISTS

SOFTWARE FOR THE BBC MICRO

MISSILE CONTROL the first implementation on the BBC Micro of the popular arcade game (32K) £9.00

MAZE MAN an authentic version of the popular arcade game (32K) £6.00

BALLOONS a highly original game that soon becomes compulsive playing (32K) £6.00

DISASSEMBLER the memory dump routine includes a scrolling back in memory facility (16K) £5.00

MISSILE CONTROL, MAZE MAN & BALLOONS use the Keyboard or Joysticks for control

30+ PROGRAMS FOR THE BBC MICROCOMPUTER

This Book contains program listings, with explanations and tips on using the BBC Micro

GAMES UTILITIES GRAPHICS & MUSIC

'ASTRO RUN' 'FASTFINDER' '3D GRAPHICS'

Most programs will run on Models A & B

Edited by C.J. Evans, various Authors.

A pair of cassettes with all the programs is available.

ISBN 0 946190 00 3

BOOK £5.00   **BOOK & CASSETTE SET £9.00**

CASSETTE LEADS for the BBC Micro

The BBC Micro comes with an incomplete cassette lead

7Pin Din to 2 × 3.5mm & 1 × 2.5mm minijacks	£4.00
7Pin Din to 5Pin Din & 2.5mm minijack	£4.00
7Pin Din to 7Pin Din	£4.00
7Pin Din PLUGS	Two for £0.65
6Pin Din PLUGS (for RGB socket)	Two for £0.65
5Pin Din PLUGS (360° for RS232)	Two for £0.65

RS423 LEADS

RS423 TO RS423 (BBC Micro to BBC Micro)

Allows two BBC Micros to 'talk' to each other

Two metre cable	£4.00
Four metre cable	£5.00

TELEVISION/MONITOR LEADS

Phono plug to Co-ax with high quality cable 3 Metres	£3.00
BNC Plug to Phono plug (i.e. BBC Micro to Rediffusion TVRM)	£2.20

PRINTER CABLES

BBC to 36 way Centronics Type connector	£17.50
BBC to 25 way D Type (for use with RS232)	£9.50
BBC to 40 way edge connector (Centronics 739)	£20.00
TORCH to 36 way Centronics Type connector	£20.00

Blank C30 Computer Cassettes

Ten for £4.00

Computer graphics design pads 100 sheets £4.00

BBC UPGRADE KITS

RAM UPGRADE (100ns)	£23.00
KIT A Printer & I/O Port	£9.50
KIT B Analogue Port	£8.00
KIT C Serial I/O & RGB	£10.00
KIT D Expansion Bus/Tube	£7.50
Full Upgrade Kit	£58.00

All components full specification

STAR DP8480 PRINTER From £250 Inc VAT

80 CPS : 80/96/132 COLS

BIDIRECTIONAL LOGIC SEEKING

TRACTOR WITH FRICTION FEED

CENTRONICS	£217.39 + £32.61 VAT = £250.00
RS232	£235.00 + £35.25 VAT = £270.25
High Res Graphics option to allow BBC Screen dumps	£15.00/£20.00

(24HR SECURICOR DELIVERY FOR PRINTERS £8.00)

VAT included where applicable

Send SAE for full Price List

POSTAGE: Add 50p on all orders under £10.00

C.J.E. Microcomputers

Dept (YC), 25 HENRY AVE, RUSTINGTON, W. SUSSEX BN16 2PA. (09062) 6647

STAR OF STA SCREEN AN LIVING-ROO

Whether your musical tastes are heavy metal or Trapp family singers the BBC Micro has something to offer. This month and next month Chris Melville shows you how to turn your BBC into a musical instrument.

THE BBC MICRO is one of the most impressive machines on the market, and its capabilities for music generation are much-praised.

That does not mean, however, that every BBC owner can immediately plug in and start emulating Gary Numan, though this article will show you how to take full advantage of the features that are present in the BBC's music box.

We will now define the initial problems you may encounter, and see what can be done to overcome them, so that our micros can start making pleasant noises.

There are two main hardware grumbles — both easy to solve. Most BBC Micros emit an annoying buzz from the loudspeaker during normal use. This is caused by signals from the data bus being amplified. A 10Kohm resistor across pins 16 and 15 of the 1MHz bus should cure it — you can either fit a plug, or solder it to the corresponding tracks on the PCB. Acorn will be doing this themselves soon.

Secondly, if the tinniness inherent in the small internal speaker is restrictive, you can connect an external amplifier of 50Kohms impedance to pin PL16 on the PCB. These modifications might affect your warranty, so check with your local Acorn Service Centre.

Statement syntax

Moving on to documentation, I presume that the Envelope and Sound statements are now understood, thanks to the new user guide and to previous articles such as that in July *Your Computer*, but briefly, the Envelope statement has the following syntax:

	Pitch envelope	Amplitude envelope
Envelope	n,1,p1,p2,p3, n1,n2,n3	a1,a2,a3,a4,t1,t2

where n is the envelope number — usually 1-4, or 1-16 if not using tape filing in Basic: and l is the length of a time step — usually 1-127 for pitch envelope repeat. Add 127 if the pitch envelope is not for repeat. The change of pitch per step in the corresponding pitch parts is given by p1,p2,p3 from −128 to 127. The number of steps in each part of the pitch envelope is designated by n1,n2,n3 from 0 to 255. The a1,a2 give the change of amplitude in attack, and change of step in decay parts, using values from −127 to 127. The a3,a4 give the change of amplitude in sustain and the change of step in release, using values from −127 to 0. The t1,t2 are the target levels for amplitude at the end of the attack, decay parts; 0 to 126. And here, briefly, is the syntax for the Sound statement:

- d = dummy flag, 0 or 1
- s = sync flag, 0 or 3
- f = flush queue flag, 0 or 1
- c = channel number, 0 to 3
- a = amplitude, 0 to −15 for envelope 1 to 16
- p = pitch, 0 to 255 for a music channel, or 0 to 7 for a noise channel
- d = duration of sound 10 to 2550ms.

In BBC Basic sound qualities are programmed using the Envelope statement as shown above. However, a statement followed by 14 parameters does not give much idea of the sound it will produce.

The EnvPlot program, for 32K, allows you to draw an envelope directly on the VDU by moving a cursor around. Then you edit it, sampling the sound produced. You define the pitch and amplitude parts separately on separate axes.

EnvPlot enables the user to start from scratch and define both pitch and amplitude envelopes on the screen. The program is either in Pitch Mode; blue background, pitch envelope/axes displayed, pitch envelope information displayed at top of screen: or Amplitude Mode, red background, amplitude envelope/axes, and amplitude envelope information at top of screen when the user is entering or manipulating the amplitude envelope.

The two modes are interchangeable at any stage, and if you re-enter either, you will be returned to where you left off. There is a cursor on the screen which is moved about by using the arrowed keys. You cannot move the cursor anywhere that would produce out-of-range parameters.

Presssing any function key will rub out the cursor and, when the function has been executed, the cursor will reappear on the last-entered point. All of the functions are foolproof. For example, you cannot Sound the envelope unless you have completed both

BBC MUSIC

```
>>L.IST
   10REM     C.MELVILLE  1982
   11ON ERROR RUN
   12*TV255
   13MODE4:PROCINITIALISE:PRINT"YOU ARE NOW RUNNING THE ENVELOPE-DEFINE PROGRAM,
SEE SEPERATE SHEET FOR INFO."''"HIT KEY TO START....":X=GET
   14PROCAXES
   15VDU29,182;420;
   16REPEAT
   17PROCCURSOR:PROCWIPE
   18ON O% GOSUB 30,38,24,43,56,60,74,36,32
   19UNTIL N%=3
   20PROCFUNCTION:PROCWIPE
   21ON O% GOSUB 30,38,24,43,56,60,74,36,32
   22IF O%=2 GOTO 16 ELSE GOTO 20
   23END
   24IF NOT AF% OR NOT PF% GOTO60
   25SOUND1,-15,100,4:VDU4,12:PRINT"PARAMETER PRINT :-You can list the ENVE-LOPE
 parameters  that are  formed from  your graphs.This is a good way to store any
good sounds you discover for later  use.     Hit a key...":X=GET
   26CLS:PRINT"The statement would be:-"'"ENV.1,";STP;",";F%(1);",";F%(2);",";F%
(3);",";S%(1);",";S%(2);",";S%(3);",";F%(5);",";F%(6);",";F%(7);",";F%(8);",";S%
(5);",";S%(6);'"And the SOUND statement would have its  duration parameter=";
   27PRINTSTR$(INT(X%(7)*XMAX%/900*((STP-1)MOD126+1)/5)):X=GET
   28RETURN
   29REM **** ENTER PORTION ROUTINE ***
   30SOUND 1,-15,1,4:IF N%=2 PF%=-1 ELSE IFN%=7 AF%=-1
   31MOVEX%(N%),Y%(N%):DRAWX%,Y%:N%=N%+1:X%(N%)=X%:Y%(N%)=Y%:S%(N%)=DSTEPS%:F%(N
%)=FSTEPS%:RETURN
   32SOUND 1,-15,1,4:VDU4,12:PRINT"INFINITE SUSTAIN OPTION"'"You may choose infi
nite sustain for the"'"note sounded with F5 (hit I) or allow"'"it to decay norma
lly,as given by RELEASEpart of the amplitude envelope (hit N)":
   33REPEAT:INF$=GET$:UNTIL INF$="N" OR INF$="I":VDU12,5:RETURN
   34
   35 REM ** SELECT PITCH **
   36VDU4,12 :PRINT'"You are already in PITCH mode,numbskull'":SOUND1,-15,10,4:P
ROCWAIT(150):VDU12,5:RETURN
   37REM * DEL. LAST PORTION ROUTINE *
   38IFN%<4 PF%=0 ELSE AF%=0
   39IF N%=0 OR N%=4 VDU4,12: PRINT"No last-portion to delete":SOUND 1,-15,120,5
:PROCWAIT(100):VDU12,5:RETURN
```

GE

)

M



pitch and amplitude sections. All parameters entered are checked before they are accepted.

In Pitch Mode the Y-axis is labelled relative to f — which is the pitch used in the Sound statement concerned.

When moving the cursor about, remember that the dotted line can have a gradient — given as P/STP at the top — of zero even when it is not horizontal, since integer arithmetic and integer parameters cannot give totally accurate results. If the gradient of any section is zero, then, when the computer Sounds that part, there will be no pitch change.

Relative pitch

The Y-axis is the relative pitch, the X-axis is the number of steps. The actual duration of a step depends on what you have set it as.

The pitch envelope has three sections, for each section the computer needs to find the gradient, that is pitch/step; and its length in steps to use in the Envelope statement.

Whether the pitch envelope keeps cycling over is, of course, determined by the value chosen for the step length. In Amplitude Mode the Y-axis represents amplitude, the X-axis represents steps.

The parameters taken for the amplitude part of an envelope statement are somewhat odd, and the system used by the computer can cause amplitude envelopes to differ from the one you have drawn.

For this reason it is usually best to have a horizontal sustain section otherwise the note will fade quickly due to inaccuracies caused by the computer's Sound software dealing only in integers. *(continued on page 57)*

```
40SOUND1,-15,150,3:MOVEX%(N%),Y%(N%):N%=N%-1:PLOT7,X%(N%),Y%(N%):RETURN
41
42REM **** RESCALE ROUTINE ****
43SOUND1,-15,100,3:VDU4,12:PRINT"RESCALE AXIS-To pick axis type one of:-"''"X
,Y - To rescale the graph correctly."''"x,y - To scale axis but not the graph."'"
F   - To 'Forget' this operation.";
44REPEAT:*FX15,0
450$=GET$:UNTIL O$="X" OR O$="Y" OR O$="x" OR O$="y" OR O$="F"
46IF O$="F"VDU12,5:RETURN
47IFO$="Y"ORO$="y"REPEATCLS:INPUT"MAXIMUM Y-VALUE (5-83585) ",M:UNTILM>=5ANDM
<83586:PX%=XMAX%:PY%=INTM ELSEREPEATCLS:INPUT"MAXIMUM X-VALUE (3-765)",M:UNTILM>
=3ANDM<766:PX%=INTM:PY%=YMAX%
48IFN%=0GOTO54
49BAD=0:FORQ=1TON%:IFO$="x"ORO$="y" PS%(Q)=INT(S%(Q)/XMAX%*PX%+.5):PF%(Q)=FNR
OUND(F%(Q)/PX%*XMAX%/YMAX%*PY%):PX%(Q)=X%(Q):PY%(Q)=Y%(Q):GOTO51
50PF%(Q)=F%(Q):PS%(Q)=S%(Q):PX%(Q)=INT(X%(Q)/PX%*XMAX%+.5):PY%(Q)=INT(Y%(Q)/P
Y%*YMAX%+.5)
51IFPX%(Q)>900 ORABS(PY%(Q))>400 ORABS(PF%(Q))>126 ORPS%(Q)>255 BAD=-1
52NEXT:IFBAD CLS:PRINT"NO RESCALE-Bad graph":SOUND 1,-15,50,5:PROCWAIT(100):G
OTO43
53FORQ=1TON%:X%(Q)=PX%(Q):Y%(Q)=PY%(Q):F%(Q)=PF%(Q):S%(Q)=PS%(Q):NEXT
54 XMAX%=PX%:YMAX%=PY%:VDU5:PROCSCREEN:VDU29,182;420;:RETURN
55REM *** DEFINE STEP DURATION ***
56SOUND1,-15,100,4:REPEATVDU4,12:INPUT" Enter step duration (1-127 centisecs.
)",TAB(10,2),STP:UNTILSTP>=1ANDSTP<128:STP=INTSTP
57IF AF% AND INT(X%(7)*XMAX%/900*((STP-1)MOD126+1)/5)>254 SOUND1,-15,20,4:VDU
12:PRINT''"REJECTED-this value causes the amplitudeenvelope to be longer than the
 DURATION parameter in a SOUND statement can take.";:PROCWAIT(400):GOTO56
58CLS:PRINT"Do you want the pitch envelope to play  ONCE,or to keep REPEATING
 (enter O,R) ?":REPEAT:O$=GET$:UNTILO$="O"ORO$="R"ORO$="r"ORO$="o":IFO$="O"ORO$=
"o"STP=STP+127:RETURN:ELSERETURN
59REM ****** BEEP ROUTINE ******
60VDU4,12:IF AF% AND PF% GOTO 63 ELSEIF NOTPF% PRINT"PITCH";:IF NOTAF% PRINT"
 and ";
61IF NOT AF% PRINT"AMPLITUDE";
62PRINT" envelope incomplete":SOUND1,-15,10,5:PROCWAIT(100):RETURN
63PRINT" DEPRESS  one of M,N,B to produce sound M   - produces MUSIC"'"N,B -
NOISE or BUZZ respectivly"'"E   - to END this operation";:*FX15,1
64*FX15,1
65REPEAT:O$=GET$:UNTIL O$="M" ORO$="N" ORO$="B" OR O$="E":*FX15,0
66IF O$="E" RETURN
67IF INF$="N" DUR%=INT(X%(7)*XMAX%/900*((STP-1)MOD126+1)/5) ELSE DUR%=255
68IF O$="M" ENVELOPE1,STP,F%(1),F%(2),F%(3),S%(1),S%(2),S%(3),F%(5),F%(6),F%(
7),F%(8),S%(5),S%(6):SOUND&11,1,PITCH%,DUR%:GOTO64
69IF O$="N" Z%=7 ELSE Z%=3
70ENVELOPE1,STP,F%(1),F%(2),F%(3),S%(1),S%(2),S%(3),0,0,0,F%(8),0,0:SOUND&11,
1,PITCH%,DUR%:SOUND&10,-15,Z%,DUR%:GOTO64
71GOTO65
72
73REM ** AMPLITUDE ENVELOPE **
74G%=2:N1%=N%:N%=M%:X1MAX%=XMAX%:Y1MAX%=YMAX%:XMAX%=AXMAX%:YMAX%=AYMAX%
75VDU19,1,1,0;0;19,0,1,0;0;:SOUND1,-15,20,4:CLG:PROCSCREEN:VDU19,1,3,0;0;19,0
,1,0;0;4,12,29,182;100;
76IFN%<>4 GOTO80
77PRINT"        AMPLITUDE MODE"'"You may now define an amplitude envelopein th
e same way.You can use the functionkeys,F7 returns you to pitch-define mode
 (SPACE BAR TO CONTINUE)";:X=GET
78PRINT''"Note that the first 3 stages must have atotal length of less than 25
5 (20'ths ofa second)  or the  corresponding  SOUNDstatement will have  DURATIO
N parameter out of range.      (SPACE BAR...)";:X=GET
79 CLS:PRINT"You have got the option of never-ending SUSTAIN by using F8 at a
ny stage."'"Note that 'never - ending SUSTAIN' means that the RELEASE section is
 never reached.   (SPACE BAR...)";:X=GET
80    VDU4:CLS:PRINT"Part one is   ATTACK"'"Part two is   DECAY"'"Part three
is SUSTAIN"'"Part four is  RELEASE"'"        PRESENT PART: ";
81ON N%-3 GOTO 82,83,84,85,86
82PRINT" ATTACK";:GOTO87
83PRINT" DECAY";:GOTO87
84PRINT" SUSTAIN";:GOTO87
85PRINT" RELEASE";:GOTO87
86PRINT" ALL DONE";
87 SOUND1,-15,10,2:*FX15,1
88X=INKEY(300):IF N%=8 GOTO 91 ELSEREPEAT:PROCCURSOR:PROCWIPE
89ONO% GOSUB30,38,24,98,56,60,94,96,32
90UNTIL N%=8 OR O%=8:IF O%=8 RETURN
91PROCFUNCTION:ONO% GOSUB30,38,24,98,56,60,94,96,32:IF O%=8 RETURN
92 IF O%=2 GOTO 88 ELSEGOTO91
93REM***AMPLITUDE MODE FUNCTION***
94VDU4,12:PRINT"You are already in AMPLITUDE mode-DOZY'!":SOUND1,-15,50,5:PRO
CWAIT(100):RETURN
95 REM ** RETURN TO PITCH MODE **
96    M%=N%:N%=N1%:G%=1:AXMAX%=XMAX%:AYMAX%=YMAX%:XMAX%=X1MAX%:YMAX%=Y1MAX%:V
DU19,1,4,0;0;19,0,4,0;0;5,12:PROCSCREEN:VDU29,182;420;19,1,6,0;0;:RETURN
97REM ** AMP. RESCALE ROUTINE **
98SOUND1,-15,100,3:VDU4,12:PRINT"RESCALE AXIS : type one of:-"''" X,Y - Re-pl
ots graph accordingly"'" x,y - Scales axis but leaves graph"'" F - To FINISH thi
s operation.";
99REPEAT:*FX15,0
100O$=GET$:UNTILO$="X" OR O$="x" OR O$="F" OR O$="y" OR O$="Y":IF O$="F" VDU12
,5:RETURN ELSE IF O$="Y" OR O$="y" GOTO112
101 REPEAT CLS:INPUT"Maximum X-value (3 to 1400) "M:UNTILM>=3 AND M<1401:BAD=0
:PX%=INTM:IF N%=4 GOTO 111
102 FORQ=5 TON%
103IFO$="x" PX%(Q)=X%(Q):PF%(Q)=FNROUND(F%(Q)*XMAX%/PX%) ELSE PF%(Q)=F%(Q):PX%
(Q)=INT(X%(Q)*XMAX%/PX%+.5)
104NEXT:ON 9-N% GOTO 105,106,107,108
105IF PF%(8)>0 ORPF%(8)<-126 BAD=-1 ELSE IF PF%(8)=0 AND S%(8)<>S%(7) PF%(8)=-
1
106 IF PF%(7)>0 ORPF%(7)<-126 OR PX%(7)*PX%/900*((STP-1)MOD127+1)>1270 BAD=-1
ELSE IFPF%(7)=0 AND S%(7)<>S%(6) PF%(7)=-1
107IF PF%(6)>126 ORPF%(6)<-126 OR PX%(6)*PX%/900*((STP-1)MOD127+1)>1270 BAD=-1
 ELSE IFPF%(6)=0 AND S%(6)<>S%(5) PF%(6)=SGN(S%(6)-S%(5))
108IF PF%(5)>126 ORPF%(5)<0 OR PX%(5)*PX%/900*((STP-1)MOD127+1)>1270 BAD=-1 EL
SE IFPF%(5)=0 AND S%(5)<>0 PF%(5)=1
109IF BAD CLS:PRINT"NO RESCALE - bad graph.":SOUND1,-15,50,5:PROCWAIT(100):GOT
O98
110FORQ=5 TO N%:F%(Q)=PF%(Q):X%(Q)=PX%(Q):NEXT
111XMAX%=PX%:VDU5:PROCSCREEN:RETURN
112REPEAT:CLS:INPUT"Enter max. y-value (9-126) "M:UNTIL M<127 AND M>=9:PY%=INT
M:BAD=0:IFN%=4 GOTO121
113FORQ=4 TON%
114IFO$="y"PY%(Q)=Y%(Q):PF%(Q)=FNROUND(F%(Q)*PY%/YMAX%):PS%(Q)=INT(S%(Q)*PY%/Y
MAX%+.5) ELSE PY%(Q)=INT(Y%(Q)*YMAX%/PY%+.5):PF%(Q)=F%(Q):PS%(Q)=S%(Q)
115NEXT:ON 9-N% GOTO116,117,118,119
```

(listing continued on page 57)

VIC-20 ANALOGUE INTERFACE

THE **CLOYVALE VIC-20** ANALOGUE INTERFACE WILL ALLOW YOUR VIC TO MONITOR TWO INDEPENDENT DC OR AC VOLTAGE INPUTS AND TWO EXTERNAL TRIGGERS. SIMPLE TO USE • IDEAL FOR PROJECTS, EDUCATION

2 CHANNEL VOLTAGE MONITORING EACH GIVING
- DC VOLTS: 0-2 VOLTS TO 0-30 VOLTS MAX RANGE
- AC VOLTS: 30 VOLTS MAX PEAK TO PEAK LOW FREQ
- OFFSET BIAS CONTROL FOR MORE ACCURATE MONITORING BETWEEN TWO VOLTAGE LEVELS WITHIN RANGE

2 INDEPENDENT EXTERNAL TRIGGERS
ALLOWS MONITORING OF EXTERNAL SWITCHES
E.G. DOOR SWITCHES, PRESSURE MATS, RELAYS, ETC

2 CHANNEL PADDLE FACILITY
INDEPENDENT FRONT PANEL SELECTOR SWITCHES GIVE DIRECT CONTROL INSTEAD OF VOLTAGE MONITORING. ALLOWS INTERFACE POTS TO BE USED AS PADDLES FOR GAMES, X-Y POSITIONING, ETC.

ONLY £37.95 EXCL VAT, P&P
DEALER ENQUIRIES WELCOME



PLEASE SEND ME . . . . . . ANALOGUE INTERFACES AT £43.64 EACH INCL VAT ______

P&P 2.00

I ENCLOSE CHEQUE/PO TO VALUE OF ______

PLEASE INCLUDE NAME/ADDRESS/PHONE IN BLOCK CAPITALS
PLEASE ALLOW UP TO 28 DAYS FOR DELIVERY

CLOYVALE LTD UNIT 5 PLOT 1 INDUSTRIAL ESTATE
0983 854864 VENTOR, ISLE OF WIGHT PO38 1DX.

THE ULTIMATE ADVENTURE FOR THE SPECTRUM/ZX81 for only £9.95

AND THE CHANCE TO WIN £10,000 OR MORE IF YOU KRAKIT™



Your eccentric father has left you £10,000 in his will. In order to claim your windfall you must solve twelve clues and gain access to a bank account in which the money has actually been deposited. Be the first to crack the puzzle and the prize is yours! Plus you will win two tickets to the city of the secret KRAKIT™ vault location. The prize money is increased weekly. A telephone number will be supplied so you have the opportunity to find out just how much you could win.

RULES

1. The first qualified entrant to be confirmed by the judges to have completed all the clues correctly is the winner.
2. There will be one winner only.
3. No persons connected to Artic Computing Limited or International Publishing & Software Inc. or their families are eligible to enter KRAKIT.™
4. This offer is not valid where prohibited by law.
5. Due to the confidential nature of KRAKIT™ we regret we are unable to enter into any individual correspondence. All the required information, including how to claim the prize, is on the computer tape.
6. The winner will be required to sign an affidavit of compliance with these rules.

* When ordering please state whether for Spectrum or ZX81

ARTIC COMPUTING

DON'T MISS YOUR CHANCE TO WIN A FORTUNE!

396 JAMES RECKITT AVENUE
HULL, N. HUMBERSIDE, HU8 0JA

Dealer enquiries welcome

(continued from page 55)

The end of the sustain section determines how long the note is Sounded for, although the amplitude can reach 0 before this thus effectively ending the note.

The release section does not have to end on the X-axis, it is only its gradient that is needed for the Envelope statement. Now for a complete description of all the functions assigned to the soft keys:

F0	EnterPoint	Enters position of cursor as next point on current envelope.
F1	DeletePoint	Deletes last point entered.
F2	Parameters	Gives completed envelope as the Envelope and Sound parameters needed to produce it.
F3	RescaleAxes	Used to rescale the x and/or y axes. There are two options: first, normal rescale—in which the axis is rescaled and any of the envelope parts are adjusted suitably; second, alternative rescale—the axis is rescaled but the graph shape is left in the same position.
F4	Set Step	Used to set the length of a step, and also whether the pitch envelope auto-repeats or not.
F5	Sound Env	Demonstrates a completed envelope in one of three voices
F6	Amp Mode	Enters program into Amplitude Mode
F7	Pitch Mode	Enters program into Amplitude Mode
F8	Infinite Stn	Set any future notes with an infinite sustain part — also cancels it
F9	Unused	

Note also that Escape starts the program all over again and so Break should be used to exit the program.

I would like to offer two simple yet useful tips for saving programs (especially long ones) on cassette.

Because of the bugs present in the BBC cassette-filing system, it is a neccessary precaution to Save programs several times in order to ensure at least one will Load back. It can be very boring sitting around waiting for long programs to save so that they can be saved over again, especially at 300 baud, so a good idea is to type:

```
*KEY 0 SAVE "programname"
|M|MTIME=0:REPEAT:UNTIL TIME =500|M
```

Then set your cassette recording and press soft key F0 say four times, one for each copy. You can then go away and have a cup of tea — the program will be saved four times with an inter-program gap of five seconds for those recorders with no motor control.

A much-criticised oversight on the BBC is the lack of a Verify command, since *CAT is not really the same thing. However if you try:

```
*LOAD "" 8000
```

then the computer will load the target program from hexadecimal 8000 onwards, which is, of course, read-only memory in the BBC Micro. However, although nothing is actually loaded into RAM, the machine still thinks it is loading a proper program. It will thus report any errors that occur, including the corrupting of block 00 — the most common of the cassette-filing system bugs.■

(listing continued from page 55)

```
116IF PF%(8)>0 OR PF%(8)<-126 OR PS%(8)>126 BAD=-1 ELSE IF PF%(8)=0 AND PS%(8)
<>PS%(7) PF%(8)=-1
117IF PF%(7)>0 OR PF%(7)<-126 OR PS%(7)>126 BAD=-1 ELSE IF PF%(7)=0 AND PS%(7)
<>PS%(6) PF%(7)=-1
118IF PF%(6)>126 OR PF%(6)<-126 OR PS%(6)>126 BAD=-1 ELSE IF PF%(6)=0 AND PS%(
6)<>PS%(5) PF%(6)=SGN(PS%(6)-PS%(5))
119IF PF%(5)>126 OR PF%(5)<0 OR PS%(5)>126 BAD=-1 ELSE IF PF%(5)=0 AND PS%(5)<
>0 PF%(5)=1
120IF BAD GOTO109 ELSE FOR Q=5 TO N%:F%(Q)=PF%(Q):S%(Q)=PS%(Q):Y%(Q)=PY%(Q):NE
XT
121YMAX%=PY%:VDU5:PROCSCREEN:RETURN
122DEF PROCINITIALISE:XMAX%=765:YMAX%=126:AXMAX%=400:AYMAX%=126:*FX4,1
123 VDU 28,0,4,39,0,23;8202;0;0;0,12
124 *FX11,30
125 *FX12,1
126*KEY0 1
127*KEY1 2
128*KEY2 3
129*KEY3 4
130*KEY4 5
131*KEY5 6
132*KEY6 7
133*KEY7 8
134*KEY8 9
135*KEY9 :
136  *KEY10 OLD|MMODE6|MVDU19,1,5,0;0;|M|NL.|M
137DIM X%(8),Y%(8),F%(8),S%(8),PX%(8),PY%(8),PF%(8),PS%(8):FOR I%=0TO8:X%(I%)=
0:Y%(I%)=0:F%(I%)=0:S%(I%)=0:NEXT
138N%=0:X%=0:Y%=0:DSTEPS%=0:FSTEPS%=0:STP=1:G%=1:M%=4:AF%=0:PF%=0:INF$="N":PIT
CH%=126
139 VDU23,224,224,224,224,0,0;0;19,1,6,0;0;19,0,4,0;0;
140ENDPROC
141 DEF PROCCURSOR
142 VDU5 :X%=X%(N%)+INT(900/XMAX%+1):DSTEPS%=1:FSTEPS%=0:Y%=Y%(N%):PROCINFO
143XN%=X%:YN%=Y%
144 *FX15,1
145MOVE0,0:DRAW400,0:MOVE0,-100:DRAW0,100:Q%=GET
146IF Q%=137THENXN%=XN%+6:GOTO151
147IF Q%=136THENXN%=XN%-6:GOTO151
148IF Q%=139THENYN%=YN%+16:GOTO151
149IF Q%=138THENYN%=YN%-16:GOTO151
150IF (Q%-48)>0 AND (Q%-48)<10 Q%=Q%-48:GOTO 157 ELSE GOTO144
151IF FNBAD PROCREJECT:PROCINFO:GOTO143
152SOUND0,-10,1,1:PROCINFO2:PROCWIPE
153PLOT29,XN%,YN%
154MOVE XN%-4,YN%+4:PRINTCHR$224
155X%=XN%:Y%=YN%
156GOTO144
157ENDPROC
158DEF PROCAXES:VDU5,29,0;0;:MOVE182,20:DRAW182,820:IFG%=1THENQ=420:A%=32:B%=4
00 ELSEQ=100:A%=112:B%=720
159MOVE1082,Q:DRAW100,Q
160FORI%=170TO1070STEP100:MOVEI%,Q+16:PRINT":":NEXT
161FORI%=170TO1070STEP300:MOVEI%,Q-6:PRINTSTR$(INT((I%-170)/900*XMAX%+.5)):NEX
T
162FORI%=A%TO832STEP80:MOVE0,I%:IFQ=100 Q$="  " ELSEQ$="F":IFI%>Q Q$="F+"
163PRINTQ$:STR$(INT((I%-Q-12)/B%*YMAX%)):MOVE164,I%:PRINT"-":NEXT
164VDU29,182;0;:ENDPROC
165
166DEF PROCREJECT:SOUND1,-15,100,5:VDU4,12:PRINT"Not allowed-outside parameter
 range":PROCWAIT(100):VDU5:ENDPROC
167DEF PROCWAIT(T%):TIME=0:REPEAT UNTIL TIME>T%:ENDPROC
168DEF PROCINFO:IF N%<4 A$="Pitch/step=":B$="Steps":C$="P/Stp":D$="PITCH " ELS
E A$="Amp./step =":B$="Amp. ":C$="A/Stp":D$="AMPLITUDE"
169VDU4,12:PRINT"CURSOR: ";TAB(19,0);D$;" envelope";TAB(0,1);"Part      ="';A$;
'B$;"     ="''"Step time = ";(STP-1)MOD127+1;" cs.";TAB(19);"Pitch repeat : ";:IF
 STP>127 PRINT"OFF"; ELSE PRINT"ON";
170 IFN%=0 OR N%=4 GOTO173 ELSEPRINTTAB(19,1);"Point";TAB(19,2);C$;TAB(19,3);B
$;
171 IF N%<4 THEN Q=0 ELSE Q=4
172 REPEAT Q=Q+1:W%=20+(Q MOD4)*5:PRINTTAB(W%,1);"*";Q MOD4;"*";TAB(W%,2);F%(Q
);TAB(W%,3);S%(Q);:UNTIL Q=N% OR Q=7
173PROCINFO2:ENDPROC
174 DEF PROCWIPE:MOVEX%-4,Y%+4:GCOL0,0:PRINTCHR$224:GCOL0,1:MOVE X%,Y%:PLOT7,X
%(N%),Y%(N%):ENDPROC
175 DEF PROCINFO2:VDU4:PRINTTAB(12,1);N%MOD4+1;TAB(12,2);FSTEPS%;"   ";TAB(12,
3);DSTEPS%;"  ";:VDU5:ENDPROC
176DEF PROCSCREEN:CLS:PROCAXES:MOVE0,0:IFN%=8 THEN Q=5 ELSE Q=N%DIV4*4
177FORQ=Q TO N%:DRAWX%(Q),Y%(Q):NEXT:ENDPROC
178 DEF FNROUND(X)=INT(ABS(X)+.5)*SGNX
179  DEF FNBAD:ON N%+1 GOTO 180,180,180,180,182,185,188,191
180 PDSTEPS%=INT((XN%-X%(N%))/900*XMAX%):IF PDSTEPS%<=0 OR PDSTEPS%>255 THEN =
-1
181 PFSTEPS%=FNROUND((YN%-Y%(N%))/400*YMAX%/PDSTEPS%):IF ABS(PFSTEPS%)>126 THE
N =-1 ELSE FSTEPS%=PFSTEPS%:DSTEPS%=PDSTEPS%:=0
182 V%=INT(XN%/900*XMAX%):IFV%<=0 OR V%*((STP-1)MOD127+1)>1270 =-1
183IF YN%<0 OR YN%>720 =-1 ELSE PDSTEPS%=INT(YN%/720*YMAX%+.5):PFSTEPS%=INT(PD
STEPS%/V%+.5):IF PDSTEPS%<>0 AND PFSTEPS%=0 PFSTEPS%=1
184IF ABSPFSTEPS%>126 =-1 ELSE FSTEPS%=PFSTEPS%:DSTEPS%=PDSTEPS%:=0
185 W%=INT((XN%-X%(N%))/900*XMAX%):IFW%<=0 OR (V%+W%)*((STP-1)MOD127+1)>1270 =
-1
186IF YN%<0 OR YN%>720 =-1 ELSE PDSTEPS%=INT(YN%/720*YMAX%+.5):PFSTEPS%=INT((Y
N%-Y%(N%))/720*YMAX%/W%+.5)
187 IF PFSTEPS%=0 AND PDSTEPS%<>S%(5) PFSTEPS%=SGN(PDSTEPS%-S%(5)): GOTO 184 E
LSE GOTO 184
188 U%=INT((XN%-X%(N%))/900*XMAX%):IFU%<=0 OR (V%+W%+U%)*((STP-1)MOD127+1)>127
0 =-1
189IF YN%<0 OR YN%>Y%(N%) =-1 ELSE PDSTEPS%=INT(YN%/720*YMAX%+.5):PFSTEPS%=INT
((YN%-Y%(N%))/720*YMAX%/U%+.5):IF PFSTEPS%=0 AND PDSTEPS%<>S%(6) PFSTEPS%=-1
190IF PFSTEPS%<-126 OR PFSTEPS%>0 =-1 ELSE FSTEPS%=PFSTEPS%:DSTEPS%=PDSTEPS%:=
0
191 IF XN%<=X%(N%) OR YN%>Y%(N%) OR YN%<0 =-1 ELSE PDSTEPS%=INT(YN%/720*YMAX%+
.5):PFSTEPS%=INT((YN%-Y%(N%))/720*YMAX%/((XN%-X%(N%))/900*XMAX%)+.5)
192IF PFSTEPS%<-126 =-1 ELSE FSTEPS%=PFSTEPS%:DSTEPS%=PDSTEPS%:=0
193DEF PROCFUNCTION:PROCINFO:VDU4,30:PRINT"You may now use    "'" any of F0-F9
  "'"   WAITING......"'"                    ";:VDU5
194*FX15,1
195 Q%=GET-48:IF Q%<2 OR Q%>10 GOTO194 ELSE ENDPROC
```

ZX81 Spectrum
MANAGEMENT GAMES

Airline — £5
Can you compete with British Airways? You must decide on the number of aircraft to operate, whether to buy or charter, whether to enter into a loan or a fuel contract and the levels of staffing and maintenance. Problems encountered are tax demands, strikes, cancelled flights, hijacks and aircraft crashes.

Autochef — £5
As MD of a Cetering Company you must negotiate for leases, decide on menu prices, level of wages, advertising and dividends. Each year you must predict the inflation rate. You are also given options on consignments of wines and food and loan contracts. You will be made to resign if you are not successful. There are 3 levels of difficulty.

Print Shop — £5
You own a small printing company and are required to decide on (a) the number and type of staff you employ and when to increase or reduce staff (b) the amount and type of paper you stock (c) the week in which work is schedules (d) the quotation for each. Are you an entrepreneur? Test your business acumen to the limit! There are 3 levels of difficulty.

Business Model Modeller X £8
This is a very User Friendly business modeller. It does not have the flexibility or the complexity of Micromodeller. However it does provide managers with a useful business tool and an introduction to modelling. The model shows the profit sensitivity and the interaction of the pertinent marketing and production factors of a business.

All Programs include detailed instructions and need 16K

DISCOUNT: £1.50 for two; £3 for three; and £5 for four

C.C.S.
DEPT YC
CASES COMPUTER SIMULATIONS
14 Langton Way
London SE3 7TL

Spectrum
Fast Action Games in Machine Code
ZX81

TREASURE HUNT (Spectrum) Explore one of the 29 mazes in search of treasure and grab as much as you can before the time limit. This game can be played with or without moving obstacles; with one player, two players in opposition, or two players in partnership; and with part or all of the maze visible. There are 144 variations of this fascinating game and even the game selector is fun to use.

HUNT (16K ZX81) A ZX81 version of Treasure Hunt with 48 variations.

X-MEN (16K ZX81) The only Puckman type game with all these features: true gobbling action, bonuses, arcade type maze, 3 lives, graphic display of lives left, 4 monsters, a den, booster buns, high score, continuous on-screen scoring.

UFO (16K ZX81) A fast moving space game in which you must defend the Earth by destroying all the UFOs and spy satellites while your moving force field gradually gets worn away by the alien bombs.

TRAP (16K ZX81) You control a moving wall and try to surround your opponent (computer or human) before he surrounds you. There are 3 speeds and games can be played with a border or wrap around screen.

£4.95 PER GAME ON CASSETTE

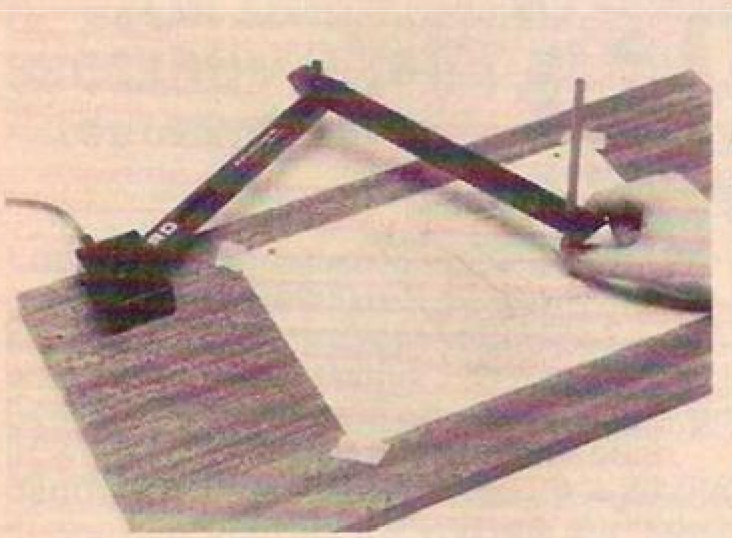
AMBA SOFTWARE
FREEPOST
(no stamp required)
CAMBRIDGE CB3 7BR

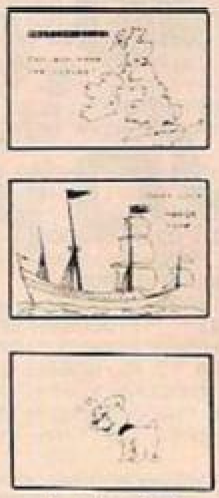
Tick games required
☐ TREASURE HUNT
☐ HUNT
☐ X-MEN
☐ UFO
☐ TRAP

NAME ....
ADDRESS ....

NEW

INSTANT IMAGE TRANSFER TO ZX SPECTRUM
RD DIGITAL TRACER £49.95





(unretouched printouts)

The high resolution colour graphics of The ZX Spectrum permit accurate presentation of complex or irregular images – maps, technical drawings, even personalities. But entering individual co-ordinates for unusual shapes can be tedious and time-consuming.

The new RD DIGITAL TRACER cuts out much tedious plotting. It provides instant transfer from original to display file – for screen display in colour, ZX printer printout, or retention on cassette.

The RD DIGITAL TRACER is of immense benefit in many fields – for geographers and weathermen, for engineers, architects and technicians, even for budding Leonardos! Designed for use with the ZX Spectrum, the RD DIGITAL TRACER as supplied is compatible with ZX 81, although high-resolution colour graphics cannot be obtained on this machine.

The RD DIGITAL TRACER is available only from RD Laboratories. The price of £49.95 includes P & P and VAT. Send your cheque now for delivery in 28 days. (Cheques payable to "RD Laboratories".) The RD DIGITAL TRACER is supplied with tracing sheet, software cassette, and full instructions on use.

Please send me .... RD DIGITAL TRACER(S) at £49.95 each. I enclose payment of £ ______ . ____

Name: ....

Address: ....

....

Send to: RD Laboratories, Dept. YCN, 5 Kennedy Road, Dane End, Ware, Herts. SG12 OLU

RD Laboratories' policy is to bring sophisticated computer techniques to low-cost computing. RD Laboratories therefore maintain the right to amend specifications at short notice. Please send stamp for further details of the RD DIGITAL TRACER, and the RD 8100 SYSTEM for automatic monitoring, test and control.

R D Laboratories
5 Kennedy Road, Dane End, Ware, Herts. SG12 OLU
(0920) 84380

If snowdrops and Spectrums are among your favourite things, these valuable machine-code routines by Jeremy Hall will help improve your micro's sound-producing ability. Impressive noises can be produced to rival the machine-code routines used by software houses.

SOUND OUT YOUR SPECTRUM

WITH A LITTLE knowledge of machine code and of how the Spectrum produces sound, some quite impressive noises can be produced, despite its limited sound facility.

The Spectrum produces sound by sending a series of clicks to its internal loudspeaker. The time interval between each click, and hence the pitch of the note, is dependent on the value held in the HL register pair of the Z-80. The higher the value stored in HL, the longer the interval between clicks, hence the lower the pitch of the note produced, and vice versa. The length of the note produced, that is, the number of clicks, is controlled by the value stored in the DE register pair; the larger the number, the longer the note.

Having set these registers to the required values, it is then simply a matter of calling the sound-producing routine in the Basic ROM. This starts at address 03 B5 hex, 949 decimal. Program 1 demonstrates this idea very simply, and figure 1 shows the machine-code mnemonics of this program. Try changing some of the values of HL and DE in this program by altering the Data statements, but before you do this, save the program on cassette in case you crash the system.

It probably will not take you very long to tire of program 1 and you will want to move on to some more interesting sounds. This is where program 2 comes into it; figure 2 shows the machine-code mnemonics for this program. Register B is loaded with the number of times that the whole sound is to be repeated. Try loading it with 1, that is change the second number in the data statement from 10 to 1.

HL and DE are set to the required value and the sound routine called. On returning from the routine, DE is loaded with 16, which is then added to HL to increase its value, and lower the pitch of the next note. The sound routine is then called again, and this process repeated 255 times. Register B is then decremented and if it is zero the program will end and return to Basic, otherwise the whole process will be repeated. Note that registers HL and BC must be saved by it.

In the final program, program 3, the machine code held in each data statement is based on the previous program, but with different values of HL and DE in each case. Enter the program exactly as shown, with the correct number of zeros after each Data statement. These zeros are used as padding to make each routine 30 bytes long and thus make each USR address easier to remember — 32400 to 32430 and so on. Try experimenting with the values of HL and DE again; you might be surprised at the results. ■

Program 1.

```
10 CLEAR 32499
20 FOR a = 32500 TO 32509
30 READ n : POKE a , n
40 NEXT a
50 DATA 17 , 128 , 0
55 DATA 33 , 0 , 3
60 DATA 205 , 181 , 3
65 DATA 201
100 RANDOMISE USR 32500
```

```
10 CLEAR 32499
20 FOR a = 32500 TO 32529
30 READ n : POKE a , n
40 NEXT a
50 DATA 6, 10, 197, 33, 15, 0, 17, 20, 0, 229,
   205, 181, 3, 225, 17, 16, 0, 167, 237, 90,
   125, 254, 255, 32, 237, 193, 16, 230, 201, 0
60 RANDOMISE
   USR 32500
```

Program 2.

```
10 CLEAR 32399
20 FOR a = 32400 TO 32549
30 READ n : POKE a , n
40 NEXT a
50 DATA 6, 3, 197, 33, 15, 0, 17, 40, 0, 229,
   205, 181, 3, 225, 17, 4, 0, 167, 237, 90,
   125, 254, 255, 32, 237, 193, 16, 230,
   201, 0
60 DATA 6, 20, 197, 33, 0, 3, 17, 1, 0, 229,
   205, 181, 3, 225, 17, 16, 0, 167, 237, 82,
   32, 240, 193, 16, 233, 201, 0, 0, 0, 0
70 DATA 6, 5, 197, 33, 15, 0, 17, 40, 0, 229,
   205, 181, 3, 225, 17, 16, 0, 167, 237, 90,
   125, 254, 255, 32, 237, 193, 16, 230,
   201, 0
80 DATA 6, 2, 197, 33, 0, 6, 17, 5, 0, 229,
   205, 181, 3, 225, 17, 8, 0, 167, 237, 82,
   32, 240, 193, 16, 233, 201, 0, 0, 0, 0,
90 DATA 6, 50, 197, 33, 0, 1, 17, 1, 0, 229,
   205, 181, 3, 225, 17, 16, 0, 167, 237, 82,
   32, 240, 193, 16, 233, 201, 0, 0, 0, 0
100 RANDOMISE USR 32400
110 RANDOMISE USR 32430
120 RANDOMISE USR 32460
130 RANDOMISE USR 32490
140 RANDOMISE USR 32520
150 GO TO 100
```

Program 3.



Mnemonic	Hex	Decimal	Comment
LD DE, 128	11 7F 00	17 128 0	Note length
LD HL, 768	21 00 03	33 0 3	Pitch
CALL 949	CD B5 03	205 181 3	Call sound
RET	C9	201	Return to Basic

Figure 1.

Mnemonic	Hex	Decimal	Comment
LD B , 10	06 0A	6 10	Repeat sound 10 times
PUSH BC	C5	197	
LD HL ,15	21 0F 00	33 15 0	Initial pitch
LD DE ,20	11 14 00	17 20 0	Note duration
PUSH HL	E5	229	
CALL 949	CD B5 03	205 181 3	Sound routine
POP HL	E1	225	
LD DE , 16	11 10 00	17 16 0	Decrease
AND A	A7	167	the
ADC HL , DE	ED 5A	237 90	pitch
LD A , L	7D	125	Repeat
CP 255	FE FF	254 255	255 times
JRNZ -18	20 ED	32 237	
POP BC	C1	193	
DJNZ -25	10 E6	16 230	Dec B, repeat if not zero
RET	C9	201	Return to Basic

Figure 2.

```
   5 REM sound analysis
         © J.D.M.Edwards
  10 INPUT "Number of words ";no
  20 DIM a(no,175)
  25 DIM a$(no,20)
  30 DIM b(175)
  35 DIM c(no)
  36 FOR n=1 TO no: LET c(n)=0:
NEXT n
  40 INPUT "Which sound (1-";(no
);")  ";q
  50 GO SUB 1000
  60 FOR n=1 TO 175
  70 IF c(q)=0 THEN LET a(q,n)=b
(n)
  80 IF c(q)=1 THEN LET a(q,n)=(
a(q,n)+b(n))/2
  90 NEXT n
  95 IF c(q)=0 THEN INPUT "Word
";a$(q)
 100 LET c(q)=1
 110 GC SUB 2000: GO SUB 3000
 120 PRINT AT 0,0; OVER 1;"Press
 'c' to cont,'r' to learn"
 123 BEEP 1,30
 125 PRINT AT 0,0; OVER 1;"Press
 'c' to cont,'r' to learn"
 130 IF INKEY$="" THEN GO TO 130
 140 IF INKEY$<>"c" AND INKEY$<>
"r" THEN GO TO 130
 150 IF INKEY$="r" THEN GO TO 40
 160 GO SUB 1000
 165 GO SUB 2000
 166 GO SUB 3000
 170 DIM d(no)
 180 FOR m=1 TO no
 190 FOR n=1 TO 175
 200 IF ABS (a(m,n)-b(n))>10 THE
N LET d(m)=d(m)+1
 210 NEXT n
 220 NEXT m
 230 LET low=9999
 235 LET wor=0
 240 FOR n=1 TO no
 250 IF d(n)<low THEN LET wor=n:
 LET low=d(n)
 260 NEXT n
 270 PRINT AT 10,10;a$(wor)
 280 GO TO 120
 999 STOP
1000 REM enter sound
1010 PRINT AT 0,0; OVER 1;"Speak
 After Tone"
1020 BEEP 1,30
1030 PRINT AT 0,0; OVER 1;"Speak
 After Tone"
1035 GO SUB 4000
1040 FOR n=1 TO 175
1050 LET l=USR USR "r"
1060 LET b(n)=PEEK 23608
1070 NEXT n
1080 RETURN
2000 REM draw graph (b)
2005 FOR n=0 TO 21: PRINT AT n,0
;"               ": NEXT n
2010 FOR n=1 TO 175
2020 PLOT 0,n
2030 DRAW b(n)/2,0
2040 NEXT n
2050 RETURN
3000 REM draw graph (a)
3005 FOR n=0 TO 21: PRINT AT n,1
5;"               ": NEXT n
3010 FOR n=1 TO 175
3020 PLOT 127,n
3030 DRAW a(q,n)/2,0
3040 NEXT n
3050 RETURN
4000 REM wait
4010 LET l=USR USR "r"
4020 IF PEEK 23608=0 THEN GO TO
4010
4030 RETURN
```



BEFORE ENTERING the main Basic program the machine-code routine should be entered using the following Basic program.

```
10 FOR n=USR "r" TO USR "u"
20 INPUT a
30 POKE n,a
40 NEXT n
```

After entering the program, type Run and press Enter, then enter the numbers in the left-hand column taking / as Enter. The mnemonics are included for machine-code enthusiasts.

```
33/56/92/          LD HL,(5C38)
62/0/              LD A,00
119/               LD (HL),A
6/255/             LD B,FF
219/250/           IN A,(FA)
254/255/           CP FF
40/1/              JR Z 01
52/                INC (HL)
16/247/            DJNZ -9
201/               RET
0/0/0/0/0/0/0/     NOP (*7)
```

The machine code acts as a crude frequency counter by looping round 255 times and adding 1 to the location 23608 each time it hears a noise through the ear socket. We are therefore left with a number between 0 and 255 at location 23608 each time we call the routine. This number will correspond to the frequency and, to some extent, the amplitude

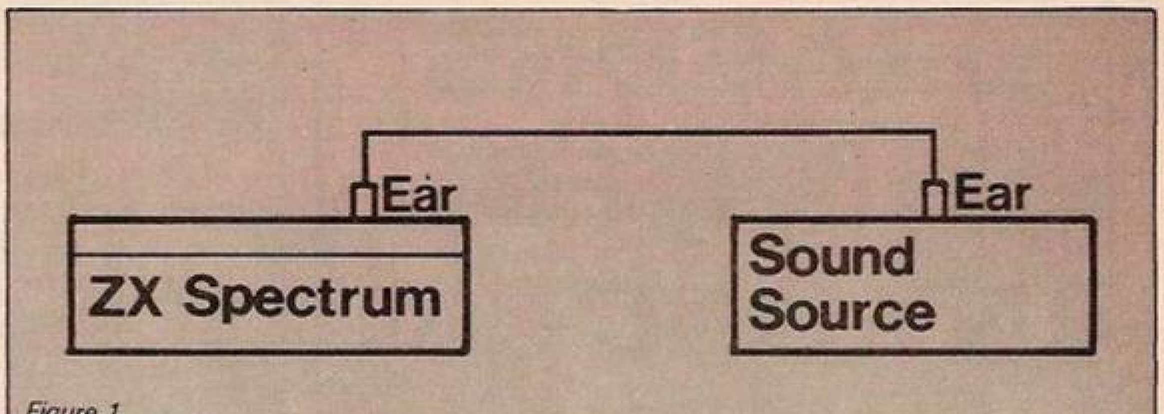
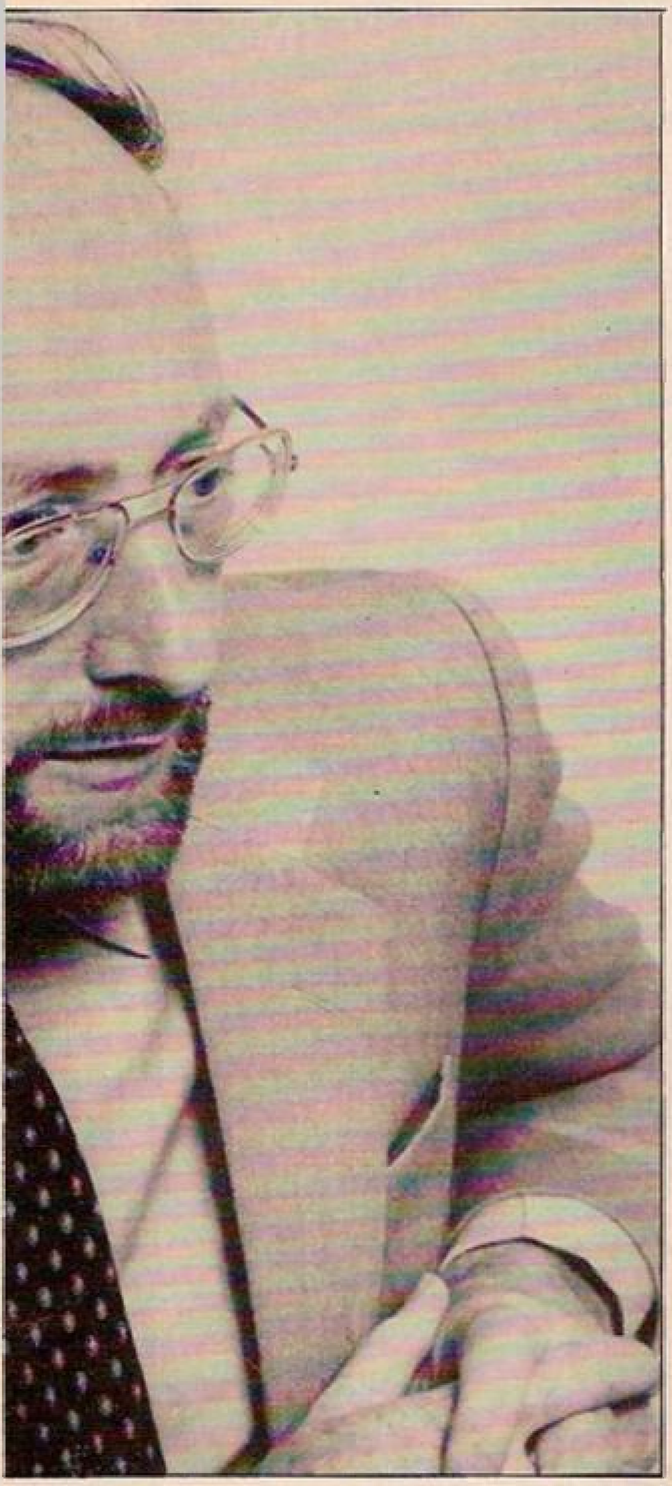


Figure 1.

TALK TO YOUR SPECTRUM

If the strain of pushing keys is telling, J D M Edwards' program lets you sit back and relax.



of the sound entering the ear socket when the routine was running.

To use the program you will need some kind of input to the ear socket; you could use a radio or a cassette recorder. To use the main Basic program you will need some way of connecting a microphone to the ear-socket, via an amplifier so that the computer can analyse your voice dynamically — as you speak.

Sound source

To use the program, plug the ear lead on the Spectrum into the ear lead of your sound source as shown in the diagram, figure 1.

If you want to see the program working but cannot connect a microphone to your Spectrum, then Enter the following short Basic program.

```
10 FOR n=1 TO 175
20 LET a=USR USR "r"
30 PLOT 0,n
40 DRAW PEEK 23608,0
50 NEXT n
60 CLS
70 GOTO 10
```

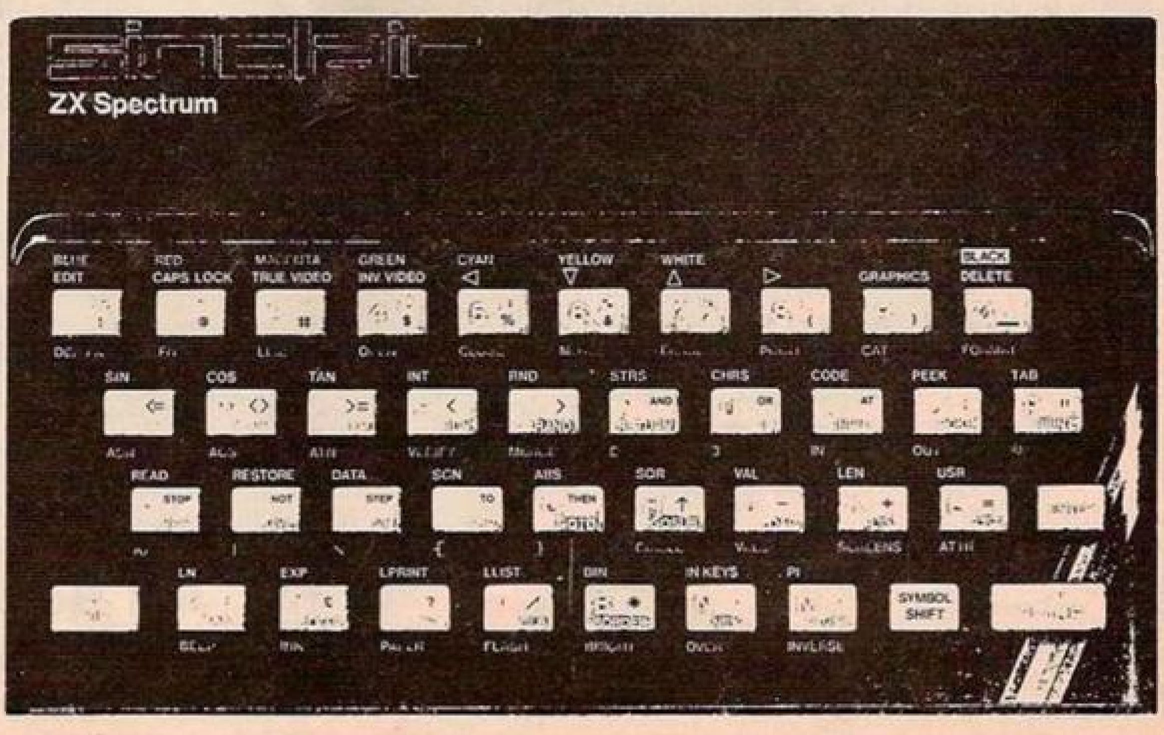
Type Run and Enter and gradually turn the volumn of your sound source up until you see a fine bar graph across about one quarter of the screen; your computer is now displaying the sound that is going into the ear socket.

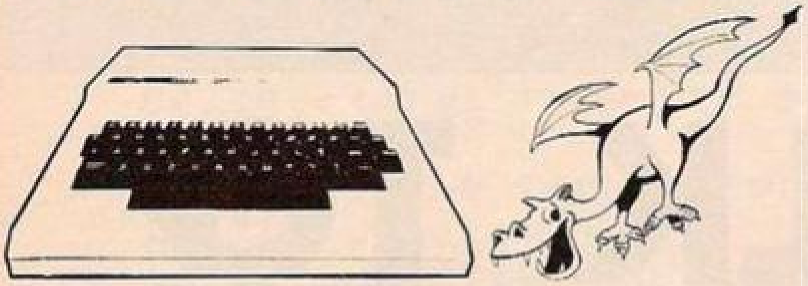
If you can connect a microphone to your computer then try this Basic speech-analysis program. After entering it, type Run and switch on your microphone. Enter how many words you want — I suggest two for your first try — then enter which word you want to enter first. You shold see the words "Speak after tone" appear, accompanied by a beep.

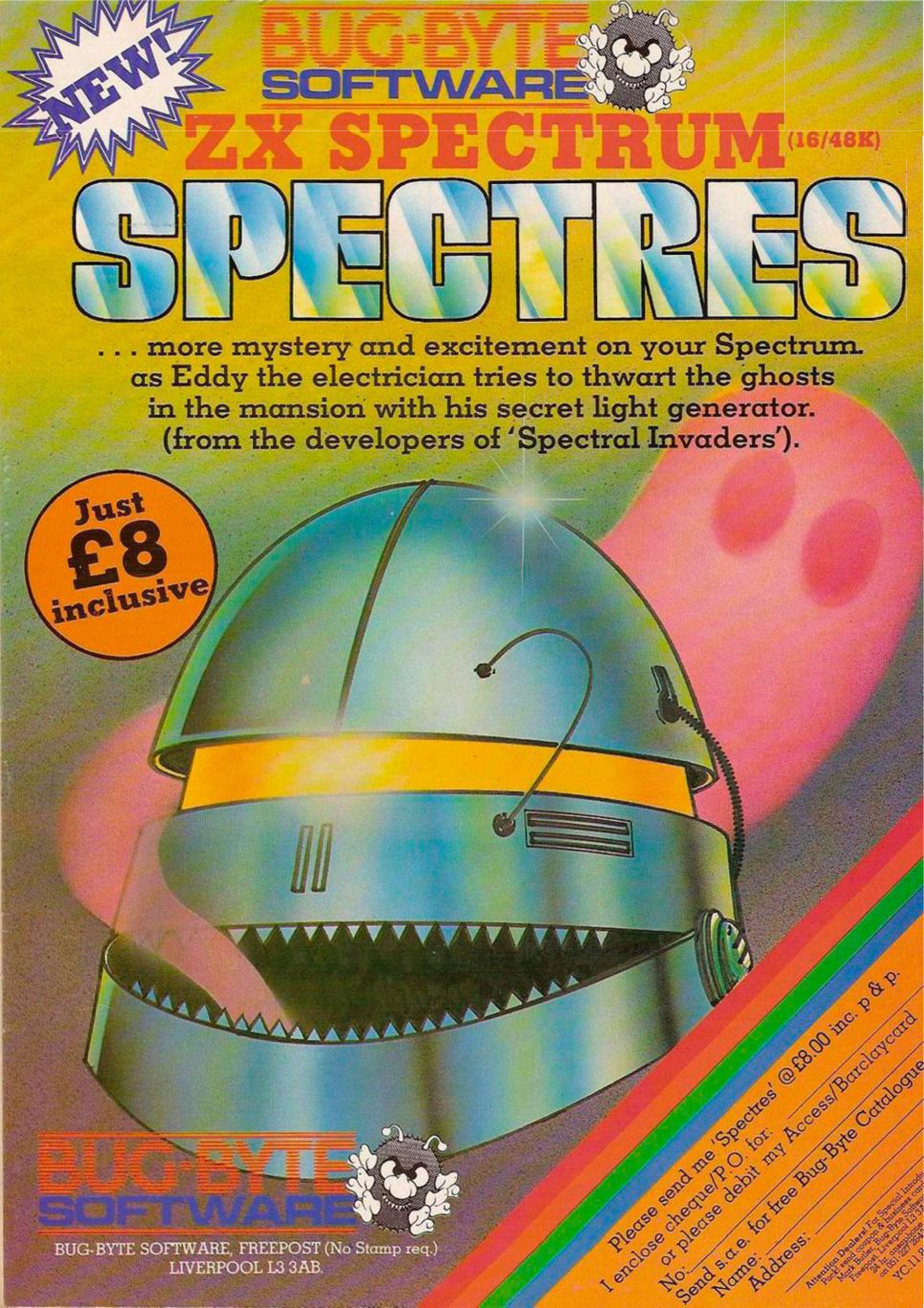
The machine will then wait for a sound in the mike before it starts inputting information, so you can take your time before saying your word after the tone has stopped. When you have said your word, sit back and wait until the machine asks for the name of the word. After entering this you will be given two graphs at the moment identical and will be asked if you want to learn or continue. Select learn and you will again be faced with the prompt "Which sound?". This time enter 2 and repeat the process. For better results repeat each word several times — not on the same analysis, but respond with each number several times to the prompt. This will be averaged out to provide a more accurate result.

Word matching

Having repeated each word several times, respond with Continue to the prompt and say one of your words after the tone. The Spectrum will sort through its files and print the word nearest to yours. Although slow, this method has a good success rate and could be rewritten in machine code to save time.






NEW!
BUG-BYTE SOFTWARE
ZX SPECTRUM (16/48K)
SPECTRES
. . . more mystery and excitement on your Spectrum as Eddy the electrician tries to thwart the ghosts in the mansion with his secret light generator. (from the developers of 'Spectral Invaders').
Just £8 inclusive
BUG-BYTE SOFTWARE
BUG-BYTE SOFTWARE, FREEPOST (No Stamp req.) LIVERPOOL L3 3AB.
Please send me 'Spectres' @ £8.00 inc. p & p.
I enclose cheque/P.O. for:
or please debit my Access/Barclaycard
No:
Send s.a.e. for free Bug-Byte Catalogue
Name:
Address:

ALL THE PROGRAMS in this series of articles will run on a 1K ZX-81. In fact if you have a RAM pack you will need to remove it, or reset RAMtop to less than 3.25K.

The first essential when producing a games program is to set up the background display. With the 1K ZX-81 the display file is collapsed, so it is impossible to Poke the characters into the display. Therefore one must first set up a display file of the size required.

In machine language there is an instruction RST 10 — D7 hex. This is a very important instruction on the ZX-81: it is only one byte long and instructs the computer to print a character, held in the A register, in the first free space on the screen. If you look at program 1 you will see how this is done.

```
16514   3E 1C   LD A, 1C   CHR$ 0
        D7      RST 10     Print it
        C9      RET        RET TO BASIC

1  REM Y0 NOT TAN
2  RAND USR 16514
```
Program 1.

With the demonstration programs 1 to 5 there is no need for a hex loader, since they all can be keyed in. Keywords are emboldened; Some keywords such as Copy are entered by typing Then Copy and erasing the word Then.

The 0 in program 1 can be replaced by any character available from the keyboard. The character will be printed in the first available print position, that is 0,0.

Program 2 demonstrates how to print up to 255 characters consecutively on the screen using the instruction DJNZ-10 hex. This instruction carries out two operations; it reduces the number held in the B register and jumps a specified distance if the number is not zero. In this case it will jump backwards −3 places FD hex. FF is −1, FE is −2, FD is −3 and so forth. The maximum number of places forward is 127 and backwards is 128.

```
16514   3E 1C   LD A, 1C   CHR$ 0
        06 FF   LD B, FF   Load B with 255
        D7      RST 10     Print a CHR
        10 FD   DJNZ-3     Reduce B by 1
                           and if not zero
                           then go back to
                           print a CHR
        C9      RET        RETURN TO
                           BASIC

1  REM Y0 ▞ COPY NOT CLEAR TAN
2  RAND USR 16514
```
Program 2.

If more than 255 characters are required then either repeat program 2, or use program 3 which enables a full screen to be set up. With this program the HL register pair is used because it can hold numbers greater than 255 — a full screen requires 726 characters. It works in a similar way to program 2, except that the check for HL zero is made using the A register. The A register is loaded with the value held in the H register and then an Or L operation is carried out on the A register.

This simply means that if H is not zero, or if L is not zero, then the result is not zero. But if H is zero and L is zero, then the result is zero.

This result can be used to jump forwards or backwards.

In this case, the jump is backwards to reload A with the character to be printed and continues until HL is zero.

The quotation marks after the 5 are a shift Q and the P before the 4 is an inverse P. The direct command is necessary because 7C is not available from the keyboard. However, not many games programs use just one character as a background. A method of printing more information on the screen is shown in program 4, where the word "Hello" is printed. This works in a similar way to the Basic

```
10 LET A$ = "HELLO"
20 PRINT A$
```

The first step is to set up Hello as Data to be read, then printed, one letter at a time. The word Hello in program 4 is held at the start of the Rem statement. In other words, address 16514 holds the letter H, 16515 holds E, 16516 holds L, 16517 holds L and 16518 holds O. HL is then loaded with 16514 — that is, it points to the first letter to be printed. The B register is loaded with 5 — the number of letters — and the A register is loaded with the contents of the address held in the HL register pair.

So the first run-through prints the letter H. The HL register pair is then increased by one to point to the letter E and the B register is reduced by one. A check is made to see if B is zero and, if it is not, a jump back to load A with contents of address held in HL is made. This process continues until all the letters are printed, that is, until B = 0.

The final demonstration program shows the memory economy available with machine language. It will print out an eight-by-eight squares checkered board and does the same as the Basic program:

```
10 LET A$="▒ ■ □ ■ ▒ ■ ▒ ■ ▒"
30 FOR A=1 TO 4
40 PRINT A$ (to 8)
50 PRINT A$ (2 to)
60 NEXT A
```

This program uses two counters: the B register to count eight characters per line and the C register to count eight lines. To save memory, the C register is also used to select the start of Data to be printed. Each board line either starts with a black square or a grey square and so only nine squares need be stored as Data.

The start address of each line is then 16514 and 16515 alternately. The start is selected by looking at Bit 0 of the number held in the C register, if it is 0 then the start is 16514 and, if it is 1, then the start is 16515. Bit 0 is the first number of the binary notation of the hexadecimal number and runs as follows:

8 = 1000
7 = 0111
6 = 0110
5 = 0101
4 = 0100
3 = 0011
2 = 0010
1 = 0001
0 = 0000

So you can see that with each run through of the program bit 0 changes from 0 to 1 to 0 etc., so that the start of Data changes from 16514 to 16515 to 16514, and so on.

The listing for the programs will look a little strange after the direct commands because of the hex 76 Newline character and the 7E character, but do not worry — the machine code is still there, as is line 2. Just the computer to list line 2. The grey squares are all graphics shift A.

Now to tackle the display for the Frogger

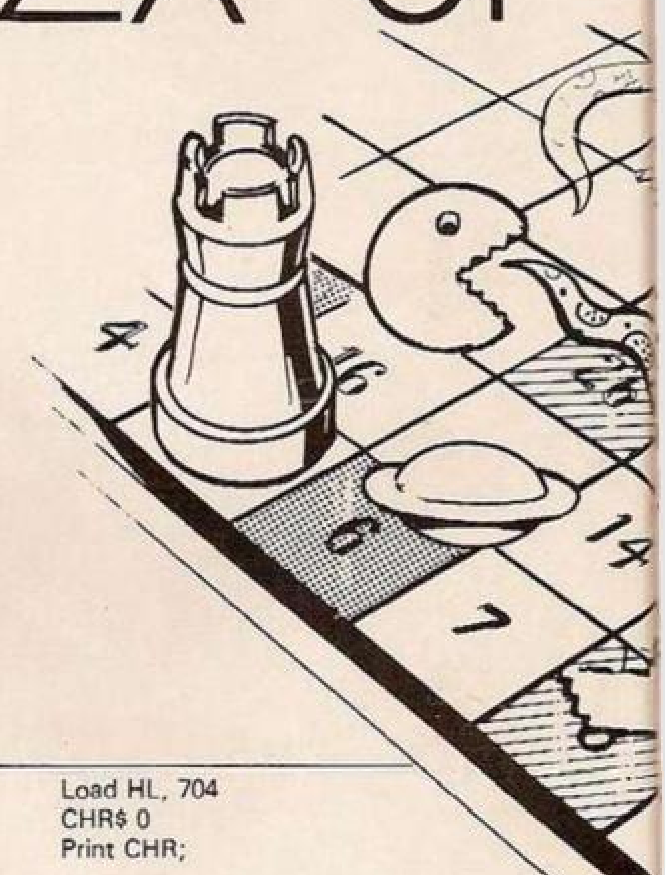
```
16514   21 C0 02   LD HL 704 dec   Load HL, 704
        3E 1C      LD A, 1C        CHR$ 0
        D7         RST 10          Print CHR;
        2B         DEC HL
        7C         LD A, H
        B5         OR L
        20 F8      JRNZ            If HL not zero, then jump relative −8
        C9         RET             Return to basic

1  REM 5 "" Y0 NOT F ? ▣ 4 SAVE TAN
   POKE 16521,124 Direct command
2  RAND USR 16514
```
Program 3.

```
16514   2D 2A 31 31 34   "HELLO" DATA
        21 82 40         LD HL, 16514
                         (40 82)
        06 05            LD B, 05
        7E               LD A(HL)
        D7               RST 10
        23               INC HL
        10 FB            DJNZ −5
        C9               RET

1  REM H E L L O 5 ▙ RND ▞ ▐ ?
   NOT 7 ( CLS TAN
   POKE 16524,126
2  RAND USR 16519
```
Program 4.

ZX-81



```
16514   08 80 08 80 08     DATA
        80 08 80 08
        0E 08              LD C, 08
        21 82 40           LD HL, 16514
        06 08              LD B, 08
        7E                 LD A, (HL)
        D7                 RST10
        23                 INC HL
        10 FB              DJNZ -5
        3E 76              LD A 76          Print N/L CHR
        D7                 RST 10           after each row
        0D                 DEC C
        C8                 RET Z            If eight rows return
                                            to Basic
        CB 41              BIT 0, C
        28 ED              JRZ -19
        21 83 40           LD HL, 16515
        18 EB              JR -21
```

```
1  REM ▒■▒■■▒■▒■▒ : ▒ 5 ▙ RND
   ▞▒? NOT 7 (CLS Y? NOT $ COS ACS
     INKEY$ C GOSUB 5 □ RND / FOR
   POKE 16530,126 Direct commands
   POKE 16536,118 Direct commands
2  RAND USR 16523
```

Program 5.

program. The technique used is exactly the same as program 4, in that the display is held in Data form and is printed from Data to the screen. Because of the length of this program it is necessary to use a hex loader Basic program to Poke the machine code into the Rem statement. So to start, type the Basic:

```
FAST
 1 REM 255 0s
 2 REM 255 0s
10 LET X=16514
20 LET A$=""
30 IF A$="" THEN INPUT A$
40 IF A$="S" THEN STOP
50 POKE X, 16*CODE A$+CODE A$(2) -476
60 PRINT AT 11,); X; ""; A$ (1 TO 2)
70 LET X=X+1
80 LET A$=A$ (3 TO)
90 GOTO 30
   RUN
```

To save typing out Rem statements, type line 1 then Edit it. This will take a second or two to bring the line into the Edit position. Then change it to line 2. The first Rem statement is used to hold the machine code to print the display; the second Rem statement is used to hold the machine code to make it move.

At each input prompt enter the hex numbers as listed. These may be entered in batches of up to 10 pairs, but remember there are no spaces between the codes. After inputting code 32 hex at address 16768 enter S to stop the Basic program and change to Slow mode.

Edit line 10 to read

LET X=16775

and Save the program for use with next month's article.

To check that your machine code is correct, change line 10 to

RAND USR 16702 . POKE 16819, 201

direct command and delete lines 20 to 90.

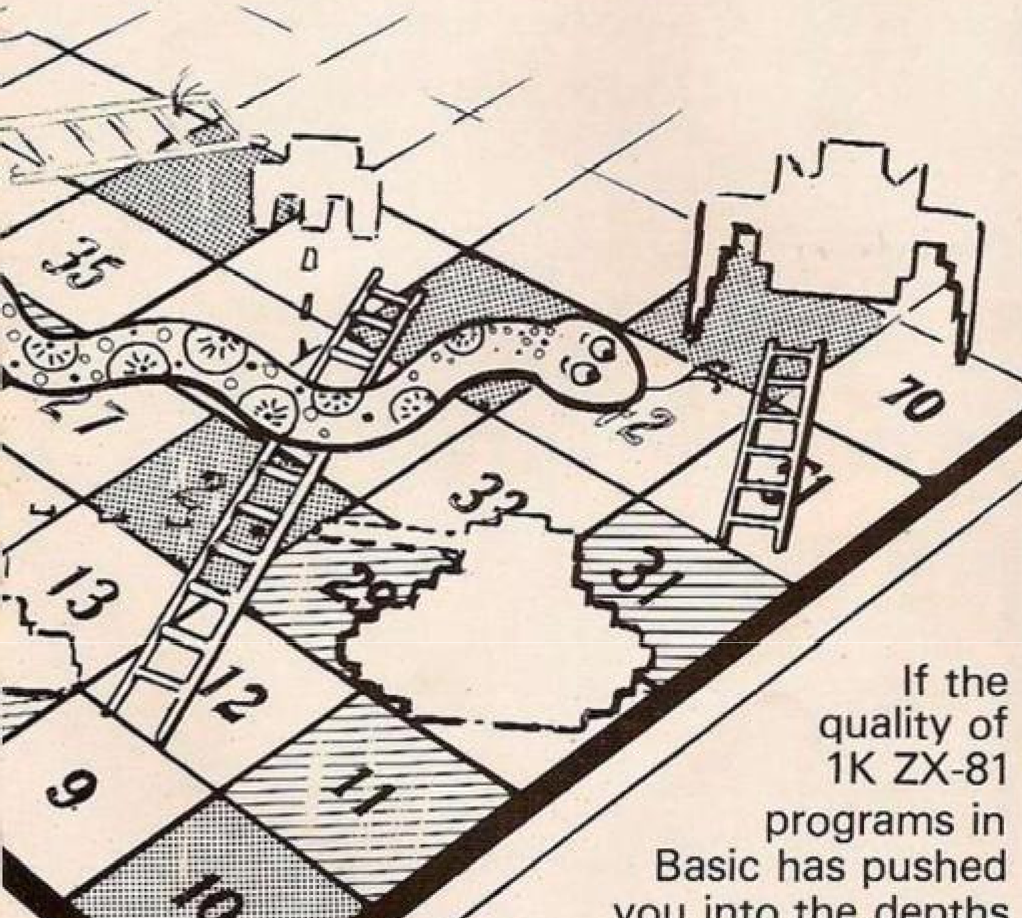
Now enter Run, and you should have a stationary display for the game.

The object of the game is to hop your frog, an inverse *, across the road, avoiding all the obstacles, to the safe middle island, then hop on to the lily pads represented by 0s and logs represented by ▀s and finally into one of the four homes. Each home is represented by a *.

The frog is controlled by pressing key 5 to go left, 8 to go right and 0 to go up. Each move up is counted, and a time limit of 199 seconds is given in which to fill all four home bases. If a frog is hit on the road, jumps into the lake, hits the wall or floats off the screen on a lily pad or log, then it is dead, and another frog is given at the base line. You cannot hop the frog off the screen.

The game finishes when all four home bases are filled or when the counter reads zero. The aim, therefore, is to fill all home bases in the quickest time, with the least number of up hops. ■

GAMES WRITING



If the quality of 1K ZX-81 programs in Basic has pushed you into the depths of despair, Stuart Nicholls' series on machine-code games writing will lead you into a new world of fast and flicker-free games.

The Frogger program.

```
16514  76 00 83 83 83 83 00 00 00 83 83 00 00 83 83 83 00 00 83 83
       00 76 1C 00 00 1C 1C 00 00 1C 00 00 1C 00 00 00 1C 00 00 1C
       00 00 76 83 00 00 83 83 83 00 00 00 83 83 83 00 00 83 83 00
       00 00 83 76 00 1C 00 00 00 1C 00 00 1C 00 00 00 00 1C 00 1C
       00 00 1C 00 76 76 80 80 93 94 8E 80 93 94 8E 80 80 80 93 94
(data) 8E 80 80 93 94 8E 76 80 80 0A 0A 82 0B 84 80 80 80 80 08 82
       80 0B 02 80 80 0B 02 76 80 93 94 8E 80 80 93 94 8E 80 93 94
       8E 80 80 93 94 8E 80 80 76 80 0A 0A 04 06 80 80 80 80 0A 0A
       0A 02 80 80 80 0B 02 80 80 76 76 3A 35 14 3C 3C 3C 08 39 2E
       32 2A 14 00 9E A5 A5

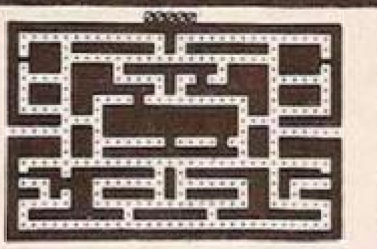
16701    3E 08      LD A, 08          Print a row of 20 'inverse' grey
         06 14      LD B, 06          squares on top line of screen.
         D7         RST 10
         10 FD      DJNZ
         21 82 40   LD HL, 16514 (40 82h)   Let HL point to start
         3E 02      LD A, 02          of DATA. Store value 2 on stack.
         F5         PUSH AF           Used to run through Print sequence
         06 55      LD B, 55          2x. Load B with number of Data CHRs
         7E         LD A, (HL)        to be Printed. Load A with character
         D7         RST 10            held in (HL) and print it.
         23         INC HL            Move to next CHR and repeat Print
         10 FB      DJNZ -5           routine until B = 0.
         3E 08      LD A, 08          Print a line of grey squares.
         06 14      LD B, 14
         D7         RST 10
         10 FD      DJNZ -3
         F1         POP AF            Get value stored on stack and reduce
         3D         DEC A             by 1. If value is not zero then
         20 ED      JRNZ -19          store on stack and repeat Print
                                      routine from 15713.
         06 11      LD B, 11          Print last 17 CHRs of DATA.
         7E         LD A, (HL)        NOTE: HL is never reset and is
         D7         RST 10            continually increased through
         23         INC HL            through Data.
         10 FB      DJNZ -5

16739    2A 0C 40   LD HL (D-FILE)    Find start of D-FILE and add
         23         INC HL            1 to set position 0.0.
         06 04      LD B, 04          Print four *s every fourth
         11 04 00   LD DE 00 04       column along top of screen.
         19         ADD HL, DE
         36 17      LD(HL), 17
         10 FB      DJNZ -5

16753    2A 0C 40   LD HL (D-FILE)    Find start of D-FILE and add 220 to
         11 DC 00   LD DE 00 DC (220)    locate middle of base-line.
         19         ADD HL, DE        Print inverse * to represent frog.
         36 97      LD (HL), 97       Store square occupied by frog at
         3E 08      LD A, 08          address 16444, the grey square.
         32 3C 40   LD (16444), A
         18 32      JR+32             Jumps into line 2 Rem to address
                                      16813.
16769    LINE 2 REM                   At this stage the Jump is to
                                      Return to Basic
```

GOBBLERS

PUCKMAN FOR 16K ZX81



BEAT THAT HIGH SCORE! GOBBLE THOSE DOTS BEFORE THOSE MEANIES GOBBLE YOU! YOUR ONLY AIDES ARE FOUR "POWER PILLS" WHICH MAKE THE MEANIES EDIBLE. BUT NOT FOR LONG!

- MACHINE CODED FOR FAST ACTION
- EXTRA "GOBBLER" FOR 10,000 POINTS
- ON SCREEN SCORING
- HIGH SCORE WITH "ENTER NAME" FACILITY
- UP TO 4 PLAYERS

AN ANNOYINGLY FRUSTRATING GAME! FOR ONLY £5.95

ASTEROIDS

FOR 16K ZX81

STAY ALIVE AS LONG AS POSSIBLE IN OPEN SPACE FILLED WITH FLYING ROCKS. SCORE BY SHOOTING THEM – WHICH ALSO CAUSES THEM TO BREAK INTO LOTS OF LITTLE BITS AND MAKES LIFE EVEN WORSE!

- MACHINE CODED FOR FAST ACTION
- ON SCREEN SCORING
- HIGH SCORE WITH "ENTER NAME" FACILITY
- UP TO 4 PLAYERS
- EXTRA SHIP FOR 1,000 PTS (NOT AS EASY AS IT SOUNDS!)
- SHIP MOVES JUST LIKE ARCADE VERSION
- ROTATE LEFT/ROTATE RIGHT/THRUST
- FIRES IN ALL 8 DIRECTIONS
- INCREASING NUMBER OF ASTEROIDS
- THREE ASTEROID SIZES
- 'NASTY' ALIEN SPACE-SHIP (FIRES BACK!)

THIS GAME IS JUST AS BAD! – AND ONLY £5.95

AN OFFER FOR REAL MASOCHISTS – BOTH TAPES FOR £9.95

MAIL ORDER ONLY-PLEASE MAKE CHEQUE/PO PAYABLE TO

THE SOFTWARE FARM DEPT B
CRAIGO FARM, BOTANY BAY, TINTERN, GWENT

EDUCATIONAL COMPUTING
on the
ZX81

Suit children ages 5-11

strongly recommended by educational authorities

No comparable collection offers so much for so little

Fifty high-quality programs to turn your ZX81 or Spectrum into a powerful educational tool.

And you don't even need to know programming. There are clear instructions and plenty of tips & advice. Designed to go beyond drill & practice the promote learning through interaction & discovery.

Almost all programs work on the **SPECTRUM**

All programs fit 1K

Creative use of graphics

Many innovative ideas

Fully documented

Includes many games

Educare's **50** 1K PROGRAMS for PRIMARY EDUCATION

Includes:-

TORTOISE
A simplified version of the famous Turtle programme

CODED MISSILE
Combines the fun of arcade games with learning

£5·95 only
paperback 110 pages plus Spectrum supplement

Graph-plotter ● Histogram ● Simon-spell ● Sketchboard ● Times-table ● Sets
Series-quiz ● XY-coordinates ● Count ● Equations ● Areas ● Guess-a-Volume
Angles ● Upstairs-Downstairs ● Music-notes ● See-saw ● Wipe-out ● Spell
Temperature ● Clock ● Money ● Snake
Mastermind ● Number-shoot ● + 26 more

EDUCARE

To: EDUCARE
139a Sloane St.
London
SWIX 9AY

Please send me .... copies Educare's 50.
I enclose cheque/postal order for £ ....
Name ....
Address ....

Let your child benefit early - Send now

SPORTING FORECASTS

Professor Frank George, one of the country's leading experts in forecasting techniques, has produced the following microcomputer programs based on his researches.

F4 FOOTBALL FORECAST

A pools forecasting program which uses stored team data to compute the expected result of each fixture.

POOLPERM

Produces full perms according to amount of stake and number of matches required.

H5 HORSE RACE FORECAST

A serious punter's aid to sensible betting. Data is entered from a sporting newspaper and the program produces betting recommendations.

A detailed instruction booklet accompanies each program. Versions are available for:

APPLE II 32K
PET 16K or 32K
SHARP MZ80K
TRS-80K 32K disk or 16K cassette
VIDEO GENIE 32K disk or 16K cassette
NEWBRAIN
SINCLAIR ZX81 16K

versions under development: **BBC; SPECTRUM**

Bureau of Information Science, Commerce House, High Street, Chalfont St. Giles, Buckinghamshire



Gainsborough House Hotel

Best Western

AA *** RAC

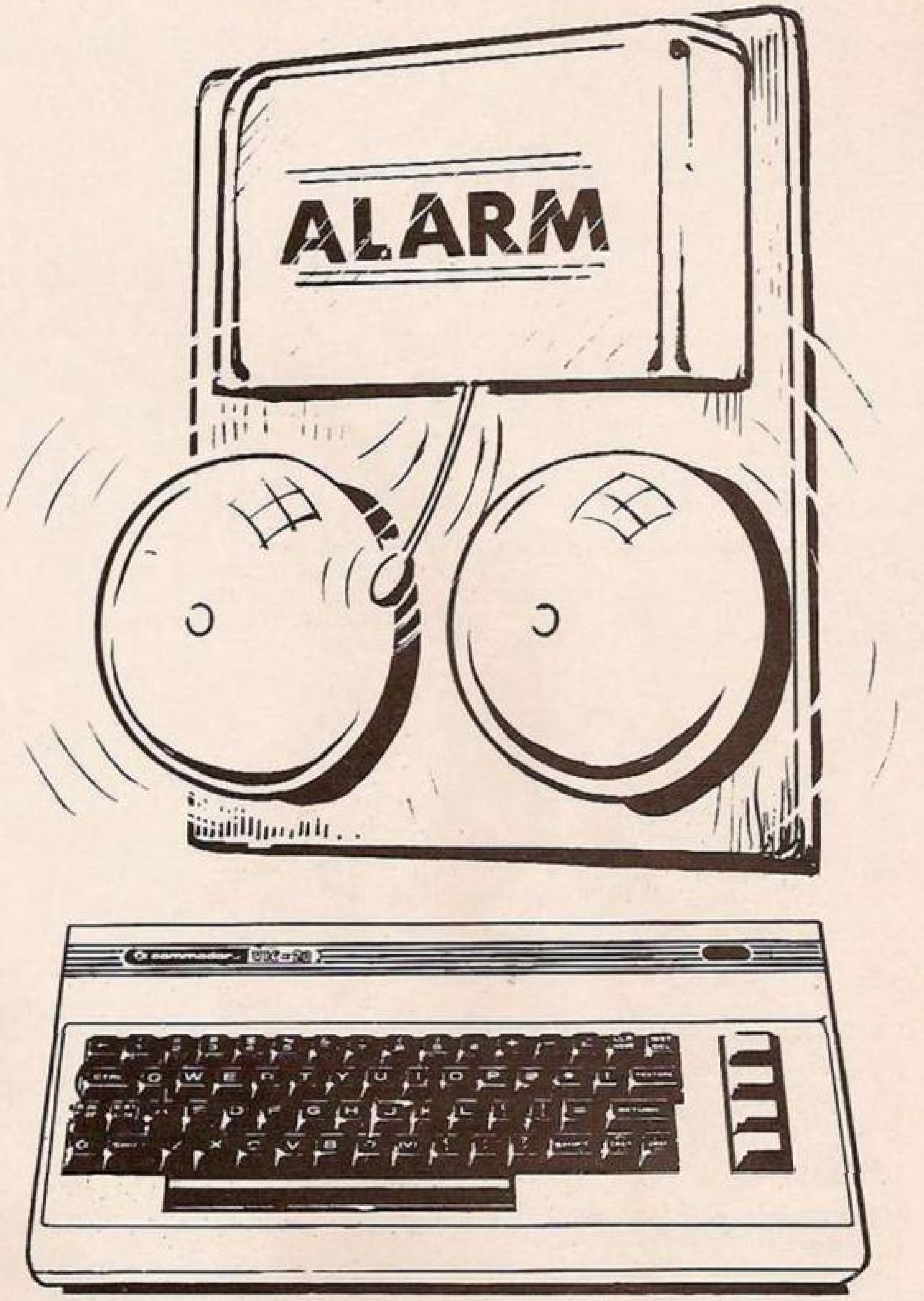
WEEKEND COURSES IN SINCLAIR BASIC

Why struggle with the book when you can learn basic and relax in the comfort of a 3 star Hotel.
Come and learn Sinclair Basic at a week-end "teach in". Friday evening to Sunday evening with 15 hours of instruction from well qualified instructors. We use the ZX81 with 20 people maximum on each course and 2 people to each computer.
The Hoel is comfortable, all bedrooms have bath, colour TV, tea making facilities and hair driers, etc. The price includes a sherry on arrival and all meals.
Our conference rooms are all well equipped with white boards, film screen and other audio visual equipment.
Courses start January, 1983 priced at £55. For further details write or contact Penny King on 0562 754041.

GAINSBOROUGH HOUSE HOTEL
BEWDLEY HILL, KIDDERMINSTER,
WORCS. DY11 6BS
Tel: (0562) 754041

HARNESSING THE VIC'S VECTOR

The Vic's operating system interrupts a program 60 times a second to scan the break key and update the time variable. Ian Hegerty shows you how to use the interrupt vector to insert your own routines for fast graphics or to check an input from an alarm bell.



THE INTERRUPT vector on the Vic is located at 788 and 789 — £0314 and £0315 in hex. Every 0.016 seconds, the 6502 processor looks at this location and jumps to a routine, the address of which is stored thus: the address divided by 256 is stored in the second location, 789, and the remainder is stored in the first, 788.

The interrupt vector may be used in the following ways. But first, stop the processor from reading the interrupt vector while you set it. If this is not done, you will get strange results — it might go to a part of the address to which you have pointed, while taking the other byte from the original value. This can be done in machine code with an SEI command: the op-code is £58.

Next, set the vector using the LDA and STA instructions. Then, restart the processor interrupting with a CLI instruction, and return with an RTS instruction. At the end of your machine-code routine, you must jump back to the original value of the vector — this increments TI and TI$ and scans the stop key and is at £EABF.

Here is an example showing the use of the interrupt vector.

```
10 REM *INTERRUPT DEMO*
20 REM *BY I HEGERTY*
30 FOR A=7424 TO 7450:READ B: IF B<>-1
   THEN POKE A,B:NEXT
40 REM *MACHINE CODE*
50 DATA 120,169,13,141,20,3,169,29,141,21,3,
   88,96
```

(continued on next page)

```
10   REM *KEY DEFINE*
20   REM *BY I.HEGERTY*
30   POKE 55,56:POKE 56,29:S = 7480
40   READ A$:IF A$ = "*" THEN PRINT "QQ TO START, SYS 7480":END
50   H = ASC(A$) - 48
60   L = ASC(RIGHT$(A$,1)) - 48
70   IF H > 9 THEN H = H - 7
80   IF L > 9 THEN L = L - 7
```

(listing continued on next page)

(continued from previous page)

```
60 DATA 169,8,141,15,144,169,27,141,15,144,
   76,191,234
```

Run it and see what happens, after you have Saved it. If it crashes, turn off the Vic, reload the program and check lines 50 and 60. When the program is successfully Run, Ready should be printed and black lines will be visible. The screen is turning black to white so fast your eye cannot see it. Here is a breakdown of the machine code in lines 50 and 60:

Hex	Mnemonic	Decimal		
78	SEI	120		
A9 0D	LDA £0D	169		13
8D 14 03	STA £0314	141	20	3
A9 1D	LDA £1D	169	29	
8D 15 03	STA £0315	141	21	3
58	CLI	88		
60	RTS	96		

This listing sets the vector, and the following listing changes screen colour.

A9 08	LDA £08	169	8	
8D 0F 90	STA £900F	141	15	144
A9 1B	LDA £1B	169	27	
8D 0F 90	STA £900F	141	15	144
4C BF EA	JMP £EABF	76	191	234

There are many applications for the interrupt vector, including graphic effects, sound effects running continuously, giving keys certain functions, and checking inputs like those from a burglar alarm. You could even control the cursor with a joystick. Keys can be programmed by looking at the value in £C5, that is, 197 decimal, and CMParing it to the values of the keys — key f1 equals 39, key f3 equals 47, key f5 equals 55, key f7 equals 63. It is important to note that these are not the ASCII values. If you want the keys plus their Shift values, you can Peek 653 — £028D in hex. If the value in this location is one, the shift key is down, if it is two, the Commodore key is down, and if the CTRL key it will be four. Combinations of these are possible — if the Shift and CTRL are both down, the value will be

1 + 4 = 5

To demonstrate all this, run the program Key Define and then

SYS 7400

Key Define uses the interrupt vector to program the function keys. Yes, those brown things on your Vic can now actually do something useful. The functions are as follows: key f1 turns the screen black; key f2 returns screen to normal; key f3 turns sound volume to full; key f4 turns off sound; key f5 turns motor power off on the cassette unit; key f6 turns motor power on on the cassette unit; key f7 makes all the keys repeat; key f8 returns to normal key repeating.

Pressing CTRL,Shift,Commodore and function key f3 results in a total reset — the same as turning off, but with the advantage that this routine may be recalled with another

SYS 7400 ■

(listing continued from previous page)

```
90    M = H*16 + L:POKE S,M:S = S + 1:GOTO 40
100   DATA 78,A9,52,8D,14,03,A9,1D,8D,15,03,58,60
110   DATA 78,A9,BF,8D,14,03,A9,EA,8D,15,03,58,60
120   DATA A2,00,A5,C5,C9,27,D0,18,BD,8D,02,C9,00,D0,05,A9,08,8D,0F,90,BD,8D,02,C9,01,D0,05
130   DATA A9,1B,8D,0F,90
140   DATA A5,C5,C9,2F,D0,18,BD,8D,02,C9,00,D0,05,A9,0F,8D,0E,90,BD,8D,02,C9,01,D0,05
150   DATA A9,00,8D,0E,90
160   DATA A5,C5,C9,37,D0,22,BD,8D,02,C9,00,D0,05,A9,00,8D,1C,91,BD,8D,02,C9,01,D0,05
170   DATA A9,FE,8D,1C,91,BD,8D,02,C9,07,D0,03,4C,22,FD
180   DATA A5,C5,C9,3F,D0,22,BD,8D,02,C9,00,D0,05,A9,FF,8D,8A,02,BD,8D,02,C9,01,D0,05
190   DATA A9,00,8D,8A,02,BD,8D,02,C9,07,D0,03,4C,22,FD
200   DATA 4C,BF,EA,*
```



How to make the best home computer in the world even better.

Peripherals to turn a powerful computer into a super-computer for the professional.

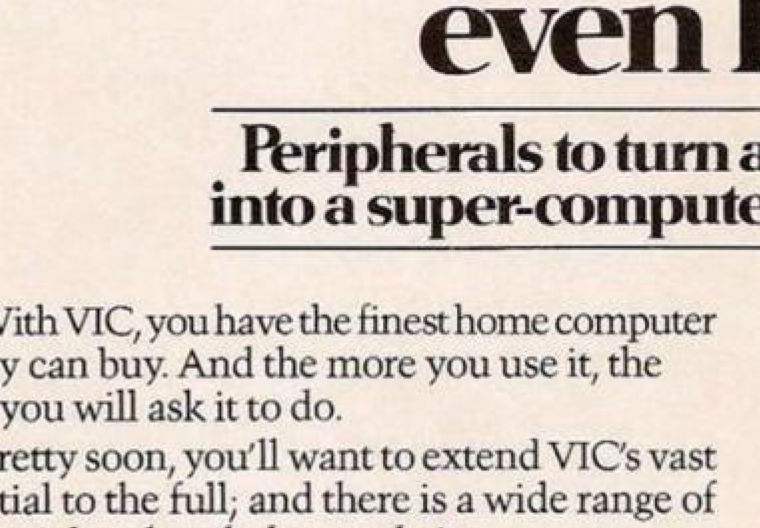
With VIC, you have the finest home computer money can buy. And the more you use it, the more you will ask it to do.

Pretty soon, you'll want to extend VIC's vast potential to the full; and there is a wide range of VIC peripherals to help you do it.

Disk drives, disk-based software, a printer, cassette unit, joysticks, paddles–with these, VIC computing becomes total computing: giving you true professional power and capability.

We describe the major units here.

VIC PRINTER



The VIC Printer, like all VIC peripherals, offers a very high specification at a very competitive price.

It will print programs, letters, business data, graphic displays and so on.

Its main features include: 80 characters per line • Tractor feed dot matrix • 30 characters per second print speed • Full alphanumerics and graphic printing • Double-size character capability • All cables and leads.

VIC FLOPPY DISK UNIT

The VIC single-drive Disk Unit provides a fast, accurate and efficient means of storing and retrieving data and programs.

Together with the Printer, it transforms the VIC 20 into the ideal system for the small businessman or serious computer programmer.

Features include: 174,848 bytes capacity • Uses soft-sectored standard 5¼" single density floppy disks • Direct interface to VIC • Direct compatibility with Printer Intelligent system independent of VIC. (VIC RAM not required to run it).



EXPANSION MEMORY CARTRIDGES

Special plug-in cartridges are available to expand VIC's memory. 3K, 8K and 16K RAM packs plug directly into the computer.



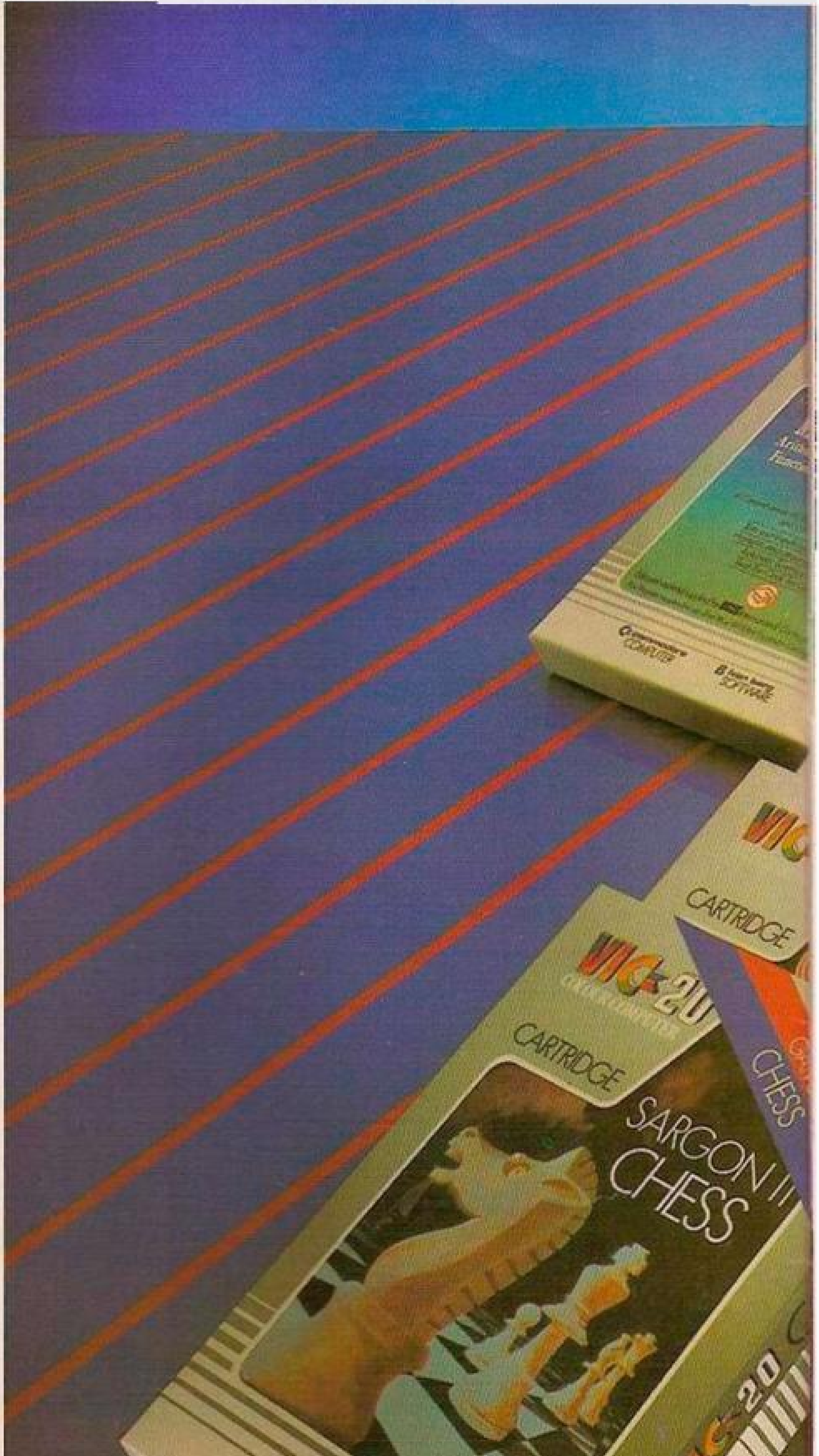
A Memory Expansion Board is also available to develop VIC's capabilities to the maximum.

For full details of VIC 20, its peripherals and software, and a list of your local dealers, contact: The Commodore Information Centre, 675 Ajax Avenue, Slough, Berkshire, SL1 4BG. Tel: Slough (0753) 79292.



commodore
VIC 20
The best home computer in the world.

Let Commodore expand your horizons.



VIC 20 is the finest home computer that money can buy.

And the better you get to know it, the more confident, adventurous and ambitious you'll become.

You'll want to take advantage of the vast range of VIC software: a superb and constantly-growing selection of programs, embracing business systems, entertainment, education and many applications in the home.

Every program in the series has been designed by experts, and chosen for its quality and value for money.

VIC business software covers a wide range of applications, including spread-sheet analysis, stock control, information handling and word-processing.

A mind-blowing range of games including Scott Adams' world-famous 'Adventure' series.

Advanced space games, including the sophisticated 'Omega Race'.

Learn subjects as diverse as English Language, programming, and biology.

And 'home' software ranges from IQ tests to Robert Carrier menus.

In addition, there is a range of VIC software, like programmers' aids and graphics packages – to add to your understanding and enjoyment of computers and computing.

There's even a special 'VicSoft' Club for VIC 20 enthusiasts, with many advantages including special offers to club members.



VIC software will expand your horizons. And your mind.

PRICES RANGE FROM £4.99 to £24.95 INC. VAT.

commodore

VIC 20

For more information, a catalogue of VIC software and details of your local retailers or dealers please phone or complete the coupon and send to:
The Commodore Information Centre,
675 Ajax Avenue, Slough, Berkshire SL1 4BG.
Telephone: Slough (0753) 79292.

Name ______
(MR./MRS./MISS)
Address ______

______

Postcode ______

VCYOC 11/82

TELETEXT ED

Martin Glass's Teletext Editor is a program with features common to commercial word-processing packages. It will run on both the Models A and B.

THE PROGRAM options are listed in the form of a menu giving five choices of action. The menu's third option gives a blank screen on which can be drawn a teletext picture with colour, graphics and double-height characters. In this mode, the four cursor keys can still be used to position the cursor anywhere.

The special teletext control codes are made available through the soft-function Copy and Tab keys. Thereby all the special teletext functions can be used to build up pictures similar to Ceefax, Oracle and Prestel. Once the picture is complete, it can be saved on tape, using the first option in the menu. Previously-stored pictures can be re-loaded using the second option. The fourth option allows you to continue editing from where you left off.

The fifth option on the menu is the Help option. This details each of the special functions available and which keys to use. See figure 1.

Key	Function
f0	Conceal Display
f1	Red
f2	Green
f3	Yellow
f4	Blue
f5	Magenta
f6	Cyan
f7	White
f8	Flashing characters
f9 + colour	Graphics
f9 + f8	Hold graphics
Tab	New background colour
f9 + Tab	Pixel-separated graphics
Copy	Double-height characters
Cursor	Move around
Escape	Return to menu
Return	Negate prior function
Control/L	Shift text left
Control/R	Shift text right
Control/D	Insert a line
Control/U	Delete a line

Figure 1. The fifth option — Help.

Different colours are chosen on keys f1 to f7, but alternative graphic characters can be selected by pressing f9 before the colour key. Pressing f0 conceals the display line by changing the foreground colour to the background.

Characters can be made to flash with key f8. To return to steady mode, press f8 then the Return key. It is important to note that the Delete key has been given the new value of 255 and not 127, so its use will produce a block character. It will not erase the previous character, but it does complete the full set of 64 graphics characters.

The Hold graphics mode — which covers over subsequent teletext control codes with the most recent graphics character — can be selected by pressing f8 immediately after f9.

Similarly, f9 followed by Tab will define the separated graphics mode, which causes each pixel in the three-by-two graphics matrix to be detailed individually.

The Tab key on its own will change the background colour to the most recently-defined colour. Therefore, a new foreground colour must be set immediately after Tab, otherwise the text will be concealed.

Double-height characters have been simplified by the program and can be accessed after using the Copy key. The program takes care of all the duplication of text usually associated with the double-height effect on the BBC Micro. To return to normal height press Copy followed by Return.

In general, the Return key will move the cursor to the start of the next line, but when used immediately after one of the special teletext functions, then the effect will be to negate that function. For example, Tab followed by Return restores the background to black.

Four functions

Four Edit mode functions move text around the screen by inserting or deleting characters. The first extra function is Control/L, that is, the Control key is held down whilst the letter L is pressed. This function deletes the character pointed at by the cursor and shifts a line of text to the left. Similarly, Control/R inserts a space and shifts the line to the right. In a likewise manner, Control/D moves text down by inserting a blank line, whilst Control/U deletes the current line and thus moves text up.

When the Editing is finished, pressing

```
10 REM * TELETEXT EDITOR *  (c) July 1982 Martin Glass.
20 MODE 7
30 HIMEM=HIMEM-&400
40 DIM A% 100
50 FOR PASS=0 TO 3 STEP 3
60 P%=A%
70[OPT PASS
80.setscreen LDA £0
90STA &70
100STA &72
110LDA £&7C
120STA &73
130LDA £&78
140STA &71
150.main LDX £4
160 .block LDY £0
170 .block1 LDA (&70).Y
180 STA (&72).Y
190INY
200 CPY £0
210 BNE block1
220 INC (&71)
230 INC (&73)
240 DEX
250 CPX £0
260 BNE block
270 RTS
280.putscreen LDA £0
290STA &70
300STA &72
310LDA £&7C
320STA &73
330LDA £&78
340STA &71
350 LDX £4
360 .block2 LDY £0
370 .block3 LDA (&72).Y
380 STA (&70).Y
390 INY
400 CPY £0
410 BNE block3
420 INC &71
430 INC &73
440 DEX
450 CPX £0
460 BNE block2
470 RTS
480 ]
490 NEXT PASS
500 ON ERROR GOTO 1060
510REM * SET UP SOFT KEYS *
520 FOR I%=0 TO 25
530?(I%+&B00)=17+I%-(I%>17)*92-(I%>10ANDI%<18)*(10-I%)
540NEXT I%
550 ?(I%+&B00)=140 :  ?(I%+&B01)=27
560 ?&B12=151
570GOTO 1080
580 KEY1%=0
590 *FX4.1
600 DOUBLE%=-2
610B%=0
620REM * MAIN ROUTINE *
630KEY%=GET
640IF KEY%=13 THEN PROCRET : GOTO 630
650 IF KEY%=18 THEN PROCINSERT : GOTO 610
660 IF KEY%=12 THEN PROCDELETE : GOTO 610
670 IF KEY%=4 THEN PROCINSERTLINE : GOTO 610
680 IF KEY%=21 THEN PROCDELETELINE : GOTO 610
690 IF KEY%=151 OR (KEY%>127 AND KEY%<135) THEN KEY%=KEY%+1 :
    PROCKEY : B%=0 : GOTO 790
700 IF KEY%=127 THEN KEY%=255:PROCKEY : GOTO 610
710 IF KEY%>31 AND KEY%<128 THEN PROCKEY : GOTO 610
720 IF B%<>16 THEN B%=-1
730 IF KEY%=9 THEN KEY%=157:KEY1%=156:PROCKEY
740IF KEY%>135 AND KEY%<140 THEN KEY%=KEY%-128 : B%=0 : PROCKEY :
    GOTO 610
750IF KEY%=27 THEN B%=16 : GOTO 630
760 IF B%<>16 THEN B%=-1
770IF KEY%=140 THEN KEY%=136 : KEY1%=137: PROCKEY
780 IF KEY%=135 THEN KEY%=141 : KEY1%=140:B%=-1 : DOUBLE%=VPOS : PROCKEY
790GOTO 630
800DEF PROCRET
810IF B%<>-1 THEN 860
820 IF KEY1%>0 THEN KEY%=KEY1%
830 KEY1%=0
840IF DOUBLE%=VPOS THEN VDU 10.8.KEY%.11
850 VDU 8.KEY%
860 IF KEY%=13 AND VPOS<24 THEN VDU13.10
870 IF KEY%=13 AND DOUBLE%=VPOS-1 THEN VDU 10
880 IF KEY%=140 THEN DOUBLE%=-2
890 B%=0
900 ENDPROC
910DEF PROCKEY
920 IF KEY%=10 AND VPOS=24 THEN 1040
930 IF KEY%=10 AND DOUBLE%=VPOS THEN VDU 10
940 IF (KEY%<>11 AND KEY%<>8) AND VPOS=24 AND POS=39 THEN 1040
950 IF KEY%=11 AND VPOS=0 THEN 1040
960 IF VPOS=0 AND POS=0 AND KEY%=8 THEN 1040
970 IF B%=16 THEN KEY%=KEY%+B%
980 IF B%=16 AND KEY%=168 THEN KEY%=152:B%=0
990 IF B%=16 AND KEY%=173 THEN KEY%=154:KEY1%=153:B%=-1
1000 IF B%=16 AND KEY%=152 THEN KEY%=158:KEY1%=159:B%=-1
1010VDU KEY%
1020 IF KEY%>31 AND DOUBLE%=VPOS OR ( DOUBLE%=VPOS-1 AND POS=0 AND
    KEY%<>11) THEN  VDU 8.10.KEY%.11
1030 IF (KEY%=9 OR KEY%>31) AND DOUBLE%=VPOS-1 AND POS=0 THEN VDU 10
1040ENDPROC
1050DEF PROCDOUBLE(A$.X.Y.C):PRINT TAB(X.Y):CHR$(C+128):CHR$(141):
    A$ TAB(X.Y+1):CHR$(C+128):CHR$(141):A$::ENDPROC
1060IF ERL<>630 THEN 1080
1070 CALL putscreen
1080 VDU 12
1090*FX 4.0
1100IF ERL=1220  THEN END
1110 PROCDOUBLE("TELETEXT EDITOR".9.1.6)
```

ITOR

Escape will return control to the main menu. Back in the menu, the page can be saved on tape by choosing option 1. The screen can then be wiped clean using option 3, or the previous page can be recalled for further editing with the fourth option.

Option 2 in the menu will load a previously-stored page from tape back into memory for further editing; follow this option with option 4 to recall the edit screen. Pictures will be stored on tape, in option 1, in Filename Screen, which is constant in the program and not user-defined because the BBC OS command *Save cannot be suffixed with a Basic string-variable.

Option 3 will clear the editing-screen memory area, so be careful to save any useful pages on tape before using this option.

In Mode 7 on the BBC Micro, the screen display is stored in locations &7C00 to &7FE8 and HiMem is originally set to &7C00. The first action of the program, in line 30, is to set aside a 1K byte spare area between &7800 and &7C00 which can be later used to store a copy of the editing screen.

The machine-code routines, GetScreen and PutScreen, in lines 70 to 480 perform the function of copying the screen display — stored between &7C00 and &7FFF — to or from the secondary store, which is stored between &7800 and &7BFF.

The next section of program, lines 510 to 560, assigns the soft-function keys with single-



code values, which are used for changing colour and other effects. Note that these codes do not match the values given in the table of teletext control codes, but are altered later in the program.

The *FX 4,1 command, in line 590, disables the action of the cursor control and Copy keys, so they can be controlled by the program. The Double% variable keeps tracks of the most recent line of double-height text.

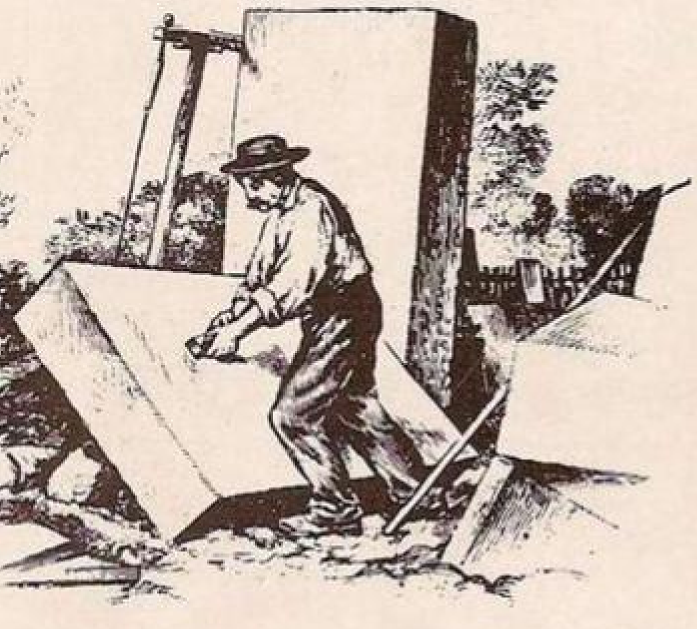
Lines 620 to 790 are the core of the Editor, which Gets a key code and acts on it. Procedures ProcRet and ProcKey are used by the Editor. The Escape key is trapped in lines 1060 to 1100, where the display screen is copied to &7800 and the cursor keys are restored to their original functions with the command *FX 4,0.

The menu-display routine is given in lines 1110 to 1240 which uses ProcDouble to write a string in double height to a specified place on the screen, in any colour.

Lines 1390 to 1690 display the Help page, Option five, while routines ProcSaveScreen and ProcLoadScreen, in lines 1700 to 1770 are used to record or recall pictures on tape, in Filename Screen. Procedures ProcInsert, ProcDelete, ProcInsertLine and ProcDeleteLine in lines 1830 to 2230 control the extra Editing functions of Control with R, L, D and U. ■

```
1120 PROCDOUBLE("M E N U",13,4,3)
1130PRINT TAB(7,10);CHR$(130);"1. Save the last screen on tape."
1140PRINT TAB(7,11);CHR$(130);"2. Load the screen from tape."
1150PRINT TAB(7,12);CHR$(130);"3. Clear the screen and start"
1160 PRINT TAB(10,13);CHR$(130);"afresh."
1170PRINT TAB(7,14);CHR$(130);"4. Continue with the edit."
1180PRINT TAB(7,17);CHR$(129);"5. Help - Edit and Function"
1190PRINT TAB(17,18);CHR$(129);"Key description."
1200PRINT TAB(8,21);"Enter the number of your"
1210 PRINT TAB(11,22);"choice (1_5)";CHR$(134);"]";
1220 B%=VAL(GET$)
1230ON B% GOTO 1250,1290,1320,1350,1390
1240GOTO 1080
1250REM * OPTION 1 - SAVE SCREEN *
1260PROCSAVESCREEN
1270B%=0
1280 GOTO 1080
1290 REM *-OPTION 2 - LOAD SCREEN *
1300 PROCLOADSCREEN
1310GOTO 1270
1320 REM * OPTION 3 - CLEAR SCREEN *
1330VDU 12
1340 GOTO 580
1350 REM * OPTION 4 - CONTINUE *
1360 VDU 12
1370 CALL getscreen
1380 GOTO 580
1390 REM * OPTION 5 - HELP *
1400 VDU 12
1410 DATA "CONCEAL DISPLAY",RED,GREEN,YELLOW,BLUE,MAGENTA,CYAN,WHITE
1420 DATA FLASHING,GRAPHICS,"DOUBLE HEIGHT"
1430 RESTORE
1440 VDU 10,13,130,157,132 : PRINT " KEY   ";:VDU129,156,156,156,157,
     135: PRINT" A C T I O N   ";CHR$(156)
1450 FOR B%=0 TO 8
1460 PRINT CHR$(128+B%);"f";B%;".";SPC(10);
1470 READ A$
1480 PRINT A$
1490 NEXT B%
1500 PRINT " f9+colour.   ";
1510 READ A$
1520 PRINT A$;" e.g.";CHR$(145);"0123"
1530 READ A$
1540 PRINT " f9+f8";SPC(8);"Hold graphics";CHR$(158);"e.g.";
1550 VDU 146,255,255,150,255,255
1560 PRINT '" tab.";SPC(9);"Background = prev. colour"
1570 PRINT " f9+tab";SPC(6);;CHR$(154);"Pixel graphics e.g."; :
     VDU 147,255,57,59
1580 PRINT '" copy. ";
1590 PROCDOUBLE(A$,12,15,7)
1600PRINT '" Use the return key to negate a function  (e.g. f8+return)"
1610PRINT " Use the escape key to return to menu."
1620 PRINT " Use the cursor keys to move around."
1630PRINT " Control/L shifts text left."
1640PRINT " Control/R shifts text right."
1650PRINT " Control/D inserts a line."
1660PRINT " Control/U deletes a line."
1670 VDU 130,157,131,136 : PRINT "   NOW PRESS 'Escape' FOR MENU";
1680 REPEAT UNTIL 0
1690 GOTO 1080
1700DEF PROCSAVESCREEN
1710PROCFILENAME("SAVE")
1720*SAVE SCREEN 7800 +0400
1730ENDPROC
1740DEF PROCLOADSCREEN
1750PROCFILENAME("LOAD")
1760*LOAD SCREEN 7800
1770ENDPROC
1780DEF PROCFILENAME(F$)
1790VDU 12,130
1800PRINT TAB(15,0);F$;" SCREEN"
1810PRINT TAB(12,15);"Align the cassette tape"'''
1820ENDPROC
1830DEF PROCINSERT
1840 V%=VPOS*40
1850 IF POS=39 THEN 1920
1860FOR INS%=39 TO POS+1 STEP -1
1870 PO%=&7C00+V%+INS%
1880?PO%=?(PO%-1)
1890NEXT
1900?(PO%-1)=32
1910IF DOUBLE%=V%/40 THEN V%=V%+40 : GOTO 1860
1920ENDPROC
1930DEF PROCDELETE
1940V%=VPOS*40
1950FOR DEL%=POS TO 38
1960PO%=&7C00+V%+DEL%
1970?PO%=?(PO%+1)
1980NEXT
1990?(PO%+1)=32
2000IF DOUBLE%=V%/40 THEN V%=V%+40 : GOTO 1950
2010ENDPROC
2020DEF PROCINSERTLINE
2030IFVPOS=24 THEN 2120
2040V%=(VPOS+1)*40+&7C00
2050FOR INS%=&7FE7 TO V% STEP -1
2060?INS%=?(INS%-40)
2070NEXT
2080 FOR INS%=V%-40 TO V%-1
2090?INS%=32
2100NEXT
2110 IF DOUBLE%>=VPOS THEN DOUBLE%=DOUBLE%+1
2120ENDPROC
2130DEF PROCDELETELINE
2140V%=VPOS*40+&7C00
2150FOR DEL%=V% TO &7FBF
2160?DEL%=?(DEL%+40)
2170NEXT
2180FOR DEL%=&7FC0 TO &7FE7
2190?DEL%=32
2200NEXT
2210IF DOUBLE%>=VPOS THEN DOUBLE%=DOUBLE%-1
2220IF DOUBLE%=VPOS-1 THEN DOUBLE%=-2 : GOTO 2150
2230ENDPROC
```

PRINT OUT



"Life would be so much easier with an Amber 2400 Matrix Printer . . . . ."

AMBER 2400
MATRIX PRINTER

LOW RUNNING COST USING PLAIN PAPER

FITS BBC, DRAGON, SPECTRUM, ATOM, TRS 80, UK101, VIC-20 AND MOST OTHERS

£69.95

---

excluding VAT

SEND LARGE STAMPED ADDRESSED ENVELOPE FOR DETAILS TO:

AMBER CONTROLS LIMITED
Central Way
Walworth Industrial Est.
Andover
Hampshire SP10 5AL

The ultimate SINCLAIR ZX 81 (16K) DATABASE FILING SYSTEM

by DALE HUBBARD

Fed up with boring games — make your ZX81 work for you!

The one you've been waiting for!!

Cassette based
Clear "menu" operation
Facilities include sort, search, list, delete, change, total numeric field, save and load file, line print, etc.
Complete with demonstration file and full instruction/application leaflet.
Requires 16K Ram pack.
Applications: Recipe file
Stamp/coin collections
Inventory Control
Employee Data
Record Collections
Magazine article catalogue
May be used for any application where fast access is required to stored information

Access accepted
Send cheque or P.O. or credit card number to:
GEMINI MARKETING LTD.
9 Salterton Road, Exmouth, Devon EX8 2BR.
Or telephone us with your credit card order on Exmouth (03952) 5832

DESPATCH BY RETURN

ONLY
£5.95 FULLY INCLUSIVE!

Special Offer
FREE
Computerised decision making program

ZX KEYBOARD

Our new cased keyboard has 52 keys, 12 of these are used for the numeric pad. The numeric pad offers some useful features; you can cursor with one hand and it will be a boon for anyone who enters a lot of numeric data.
The case measures 15 × 9 × 2½.
The computer (ZX81 or spectrum) fits neatly inside. Also fitted inside the case is a mother board (81 model only) which allows 16K, 32K and 64K to be fitted in the case. All the connections are at the rear of the case i.e. Power Mic, Ear, T.V. and the expansion port. The power supply could also be fitted inside. This means you have a very smart self-contained unit.

NOTE

The keyboard is connected to your computer by a ribbon cable and this has connectors fitted which simply push into the Sinclair connectors. It is a simple two minute job and requires no electronic skills or any soldering.



ZX81 ARCADE SOFTWARE

THE FOLLOWING EXCITING MACHINE CODE ARCADE ACTION GAMES ARE AVAILABLE FOR THE 16 K ZX81

✱CENTIPEDE ✱METEOR STORM

@ £4.95each

Fully cased with numeric pad	**£45**
Uncased with numeric pad	**£30**
Case	**£15**

- ★ 16K Ram Massive Add On Memory
  Fully assembled and tested £19.95
- ★ 64K Memory Expansion £49.95
- ★ 4K Tool kit full of utilities to aid the programmer in constructing and de-bugging E.Prom version for use with graphics Rom £9.96
  Cassette Version £6.95
- ★ Flexible ribbon connector £10
- ★ Spectrum Memory Upgrade to 48K £35

SEND S.A.E. FOR INFORMATION PACKED CATALOGUE

4K GRAPHICS ROM £29.95

The DK Graphic module is our latest ZX81 accessory. This module unlike most other accessories fits neatly inside your computer under the keyboard.
The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you an unbelievable 448 extra pre-programmed graphics, your normal graphic set contains only 64. This means that you now have 512 graphics and with their inverse 1024. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.
THE FOLLOWING SOFTWARE IS AVAILABLE FOR USE WITH THE GRAPHIC ROM @ £4.95each
✱ASTEROIDS ✱CENTIPEDE ✱DEFENDER
✱SPACE INVADERS ✱METEOR STORM

WHY WAIT?
ORDER TODAY FOR FAST DELIVERY

Please state type of machine which ROM/memory size quantity and price when ordering

Please send me .... @£ ....
Please send me .... @£ ....
Please send me .... @£ ....
Please send me .... @£ ....
Please send me .... @£ ....
Please add on £1.25 for P/P. I enclose £

Name ....
Address ....

Cheque/P.O. payable to DK Tronics

dk'tronics

23 Sussex Road,
Gorleston,
Great Yarmouth,
Norfolk.
(0493) 602453

Send off the coupon today or telephone Gt. Yarmouth for our answering service (available 24 hrs. a day 7 days a week) quoting Barclaycard or Access number).
Please add on £1.25 for P/P

These two articles, the first by Michael Fox and the second by Dale McLoughlin, set out handy machine-code routines, with a variety of uses.

ZX-81 TOO

MANY USERS WHO have no knowledge of machine code may, nevertheless, want to use it in their Basic programs to enhance speed and presentation. But most machine-code routines lead only to the development of one game or objective. The utility machine-code routines in this article are for the ZX-81, but they can also be used on a ZX-80 with 8K ROM. The effect on the last routine will be lost on the ZX-80 because of the lack of a Slow mode.

The routines contain no absolute addresses, except subroutine calls, so that you can stack them on top of another routine that does use absolute addresses, or on top of each other and they can be called individually.

The routines need a 16K RAM because they all manipulate the display file. There are four routines and I have also supplied a comprehensive loader program. The four routines are;

- A screen fill
- A downward scroll
- A text-window system
- A super-cursor

Line 1 of the machine-code loader program should contain the number of Qs needed for the machine code plus a few extra — just in case. It is best to use line 1, although any number will do as long as it is the first line. Line 1 is best because there is no risk of putting a line before it — the ZX-81 has no line 0. The length of the line can be checked by

PRINT (PEEK 16511)-2 or

PRINT (PEEK 16511+256* PEEK 16512)-2

if the length of the line contains more than 254 Qs.

To enter the machine code, run the program and enter the start location of the machine code, which is usually 16514. Now start entering the values in the third column. If you make a mistake or enter a wrong value — it has a safeguard against entering àn empty string — then enter R for repeat and the program will reinput a value for the last byte address.

If you find a discrepancy in the addresses or some such fault, type L to list the code. The program will input a new start location and list from that point onwards. If at any time you want to pause while you are checking the copy, just hold down any key — other than R — or Space and Break, and the listing will stop until the key is released.

If you press R, the program will return to loading mode and input a new start location. Whenever the location you broke out from is to be retained, enter A and it will carry on from where it left off.

It may be a good idea to type in a large line 1 and then Save the program on tape, rather than typing it in every time it is needed. To stack two or three machine-code routines in one Rem statement, the best way is to type them in one after the other and note the starting address of each routine. This is the address you should Rand USR to call the sub-

```
REM Listing 1 screenfill
ADDRESS INSTRUCTION           CODE        COMMENTS
16514                         118,118     disable list
        ld B,22               6,22        No of lines
        ld HL,(DFILE)         42,12,64
   *1   inc HL                35
        ld A,(HL)             126
        cp 118                254,118     check for N/L
        jr z,*2               40,4
16527   ld (HL),128           54,128      CHR$ to print
        jr *1                 24,246
   *2   djnz *1               16,244
        ret                   201         return to basic
                      20 Bytes
```

```
REM Listing 2 downward scroll
ADDRESS INSTRUCTION           CODE        COMMENTS
16514                         118,118     disable list
        ld HL,D FILE bottom   33,0,0      to be poked
        ld C,21               14,21       No of lines
   *    ld A,(HL)             126
        cp 118                254,118     check for N/L
        jr z,NL               40,11
        ld D,H                84
        ld E,L                93
        ld B,33               6,33        down a line
        inc DE                19
        djnz 253              16,253
        ld (DE),A             18
        dec HL                43
        jr *                  24,240
   NL   dec HL                43          N/L found
        dec C                 13          dec count
        ret z                 200
16541   jr *                  24,235
                      28 Bytes
```

```
REM Listing 3 Text window
ADDRESS INSTRUCTION           CODE        COMMENTS
16514                         118,118     disable list
        ld C,5                14,5        No of lines(5)
        ld D,23-5             22,18       23-No of lines
        ld HL,(16396)         42,12,64    DFILE
        inc HL                35
   *    ld B,33               6,33        move down to
        inc HL                35          top of window
        djnz 253              16,253
        dec D                 21
        jr nz,*               32,248
   *1   ld A,(HL)             126         start scroll
        cp 118                254,118
        jr nz,NL              40,11
        ld D,H                84
        ld E,L                93
        ld B,33               6,33
        dec DE                27
        djnz 253              16,253
        ld (DE),A             18
        inc HL                35
16546   jr *1                 24,240
   NL   inc HL                35
        dec C                 13
        jr nz,*1              32,237
        ld B,32               6,32        set next print
16554   dec DE                27          position to
        djnz 253              16,253      bottom of window
        ld (print pos),DE     237,83,14,64
        ld HL,16442           33,58,64
16564   ld (HL),21            54,21
        ret                   201
                      53 Bytes
```

```
REM Listing 4 super cursor
ADDRESS INSTRUCTION           CODE        COMMENTS
16514                         118,118     disable list
        ld HL,(DFILE)         42,12,64
        inc HL                35
   F1   ld A,8                62,8        cursor CHR$
        call NN               205,168,64  draw first line
   F2   inc HL                35
        ld A,(HL)             126
        cp 118                254,118
        jr z,C2               40,14
16531   ld A,8                62,8
        call NN               205,168,64  draw line
   C1   dec HL                43
16537   ld A,0                62,0
        call NN               205,168,64  clear line
        inc HL                35
        jr F2                 24,236
   C2   dec HL                43
16546   ld A,0                62,0
        call NN               205,168,64  clear last line
        ret                   201
   NN   ld (HL),A             119         line draw routine
        ld C,21               14,21       cursor size
        ld D,H                84
        ld E,L                93
   *    ld B,33               6,33        down a line
        inc DE                19
        djnz 253              16,253
        ld (DE),A             18
        dec C                 13
        jr nz,*               32,247
        ret                   201
                      53 Bytes
```

```
0 REM MACHINE CODE LOADER
1 REM QQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ ENOUGH FOR THE MACHINE,CODE
9000 SCROLL
9010 PRINT "START LOCATION"
9020 INPUT A
9030 INPUT A$
9040 IF A$="" THEN GOTO 9030
9050 IF A$="L" THEN GOTO 9140
9060 IF A$="R" THEN GOTO 9120
9070 POKE A,VAL A$
9080 SCROLL
9090 PRINT A;"=";PEEK A
9100 LET A=A+1
9110 GOTO 9030
9120 LET A=A-1
9130 GOTO 9030
9140 SCROLL
9150 PRINT "START LOCATION"
9160 INPUT B
9170 SCROLL
9180 PRINT B;"=";PEEK B
9190 LET B=B+1
9200 IF INKEY$="R" THEN GOTO 9000
9210 IF INKEY$<>"" THEN GOTO 9210
9220 GOTO 9170
```

LKITS

routine — all subroutines, when on their own, should be called by

RAND USR 16516

Also note that only in the first routine should the two 118s Newline appear. These disable the listing of the Rem statement but should only appear at the start. You will find that on listing only 1 Rem appears, the rest of the Basic program can be listed by List 2, or the number of any other Basic line. To avoid this problem Poke 16419 with the number of the lowest line below 255; then list that line.

Listing 1 is the screen-fill routine which fills the screen with any CHR$ except tokens and 118 which will crash the system. It works by filling the line, looking ahead one square for a Newline and when it finds one it jumps over that square.

It counts the number of Newlines and after a specified number it returns to Basic. This number — the number of lines filled can be Poked into location 16517 — is set at 22. Do not Poke it with more than 24 or with 0 for there are only 24 lines on the screen and 0 will be decremented to 255 which is above 24 and so will cause a crash. The character printed is at location 16528; it is set as a black square in the listing.

The second listing, listing 2, is a downward scroll. It works by starting at the bottom of the display file and going up loading the accumulator with what is on the screen, copies HL into DE, adds 33 to DE. This is equivalent to moving it down a line. Then it puts the contents of the accumulator in that location and goes on to the next square.

It also looks ahead for a Newline, counts the number of the Newlines found — the number of lines scrolled — and after 22 it returns to Basic. The number of lines scrolled can be altered by Poking location 16520 with the number of lines −1. If it is less than 21, the lines scrolled will be at the bottom of the screen. When you move the bottom of the screen location and reduce the number of lines scrolled, it will only scroll the top lines of the screen.

The top line of the display should be only background as this is what is copied. It must not be used after computer scrolling but can be used before. Values higher than 21 and value 0 should not be used for the number of lines.

To set the bottom of the display file the program must contain these four lines:

```
LET P=1+PEEK 16396+256*PEEK 16397
LET P=P+(22*33)-2
POKE 16517,P-256*INT(P/256)
POKE 16518,INT (P/256)
```

The number 22 in the second of these lines is the number of lines to move down. If you move the bottom of the display file as mentioned, this number should be altered accordingly. It does not upset the display file as the computer's upward scroll does.

After seeing Timothy Gilbert's article on how to protect lines at the bottom of the screen by creating a text window at the top in the February issue of *Your Computer*, I decided to write a routine to produce a text window at the bottom of the display, thereby protecting the top of the screen.

The program works by finding the start of the display file and then moving down to the top of the text window. It then moves each square on the screen up a line, looking ahead for Newlines and counting them. When it has scrolled the correct number of lines, it sets the next print position to the bottom scrolled line and sets the column number to 21. This number in the window is at location 16517 and is set at 5. Location 16519 should be Poked with 23 minus the number of lines.

The bottom line of the window is left clear after a scroll because it scrolls the top line of the bottom part of the screen which is always blank. Input does not affect the routine and vice versa. When using it in a program, rather than using scroll, use

RAND USR 16516

but do not type this in every time it is needed — it is quicker to type in the program and make a list on paper of all the scroll lines. Then, after and typing in the rest of the program, insert a

RAND USR 16516

then edit it and change the line number to produce the other Rand USRs needed as this is quicker and easier on the fingers.

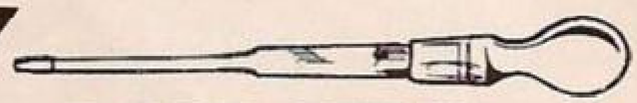
The routine can also be used to generate windows at any height anywhere on the screen. To do this, Poke 16517 with the number of lines and 16519 with the number of lines down to the top line of the window. Then use the routine as normal but you will have to leave a blank line below the window and, because it looks better, a blank line above as well. This enables two protected, separate and unmoving pictures or text to be displayed above and below a window.

The fourth and final listing is a Super Cursor. It runs a vertical line from left to right across the screen leaving a clear screen behind it. This is very impressive and the only routine which contains absolute addresses. They are in the form of subroutine calls, so if you stack the routines on top of each other; this one would have to be placed at location 16514.

The routine sets itself for the first line and calls a subroutine to draw the line. It then draws another line which clears the first and moves on in this manner across the screen looking for the end of the line. When found, it clears the last line and returns to Basic.

The location of the first cursor line CHR* is at 16521 and is set to 8; the location of the main cursor line CHR$ is at 16532 and is also set to 8. The location of the trail left is at location 16538 and the last trail line is at 16547.

HANDY HINTS





THE ZX-81 instruction set offers very little in the way of screen-controlling commands. To make up for this deficiency, these machine-code routines provide a variety of functions including flashing single characters or whole lines, a fast CLS, reverse scrolling and much more.

By far the easiest method of using machine code is to store it in a Rem statement at the beginning of a Basic program. Program 1 enables you to enter a group of machine-code instructions into the first line of the program, which can then be Saved, Loaded and used as part of longer Basic routines. Lines 10 to 80 can be removed once all the machine code has been entered — but under no circumstances should the Rem line be edited as this can remove vital instructions from the machine code.

Each routine can be used on its own since each is totally independent of the others, or they could all be entered together to form one large toolkit to be called at various points throughout a long Basic program.

Some of the routines require a Poke of some data before they are called — a line number to be deleted — and where this is necessary it is assumed that the data has already been checked for validity. For example, you cannot delete line 25 since it will cause the system to crash.

Most of the routines are called by the Basic

RAND USR 16514

where it is the first or only routine in the Rem line. If you intend to use more than one at a time you will have to calculate the appropriate calling address by adding the length of previous routines to 16514.

As a convention I have used the label Start to indicate the calling point of each routine, and any bytes to be Poked are shown in relation to this. For example:

POKE START +5;

if

START=16514

then

POKE 16519

To enter the machine code, type in program 1, counting carefully the number of Xs in line 1 — it may be best to enter them in Fast mode — and Run it. Then input the machine code in manageable blocks. Use the hex codes and watch carefully as you do it as mistakes are difficult to locate afterwards. When the code is finished enter S to stop the program.

These routines are for the ZX-81 with expanded display file — that is, with more than 3.25K of RAM — and they apply to the later ROM design. If some of them do not work it is because your ZX-81 is an early model and consequently you should change all occurrences of CD1D15 to CD1915. Additionally, if Scroll has been used to create the display then it must be cleared with CLS to recreate the expanded file, since Scroll collapses the display as if there were less than 3.25K present. Routine 10 will of course work with any memory size.

(continued on page 79)

Once upon a time . . .

. . . . in medieval days, there were dark, mysterious Forests, and within these Forests there lived mythical monsters called DRAGONS.

Now in 1982 when buying a computer you enter a technological Jungle; here within this jungle you will also find Dragons. But these Dragons are no myth.





DRAGON 32

ONLY £199.50

PLUS £3 P/P

The heart of the system is a 6809E micro-processor, a great advance on the still popular 6502, with a 32K Memory as standard, expandable to 64K. Uses **Extended Microsoft Colour Basic**, 9 colours available, 5 resolutions of graphics up to 256 x 192, displayed on TV set or composite colour monitor. Generates a full five octave sound range through the TV Speaker.

Unlike other systems in this price range it uses a conventional QWERTY Keyboard.

Standard connections include:—
- ROM Cartridge
- 2 Joystick controllers
- Remote cassette unit
- Centronics Parallel printer

160 page "BASIC" Manual included with every system.

All this for the unbelievably low price of only **£199.50 including V.A.T, plus £3.00 post and packing.**

Computers for All

72 NORTH STREET, ROMFORD, ESSEX. TEL. 0708 752862



Television not included in price.

Please send me — *Total*

.... Dragon 32 @ £199.50 ea. ....
.... Dragon Joysticks @ £19.95 pr. ....

Cartridges

.... Ghost Attack @ £24.95 ea. ....
.... Berserk @ £19.95 ea. ....
.... Meteoroids @ £19.95 ea. ....
.... Cosmic Invaders @ £19.95 ea. ....
.... Cave Hunter @ £19.95 ea. ....
.... Tube Frenzy @ £19.95 ea. ....
.... Starship Chameleon @ £19.95 ....
.... Personal Finance @ £19.95 ea. ....

Cassettes

.... Compendium of Games @ £7.95 ea. ....
.... Comp. of Applications @ £7.95 ea. ....
.... Quest @ £7.95 ea. ....
.... Madness & the Minotaur @ £7.95 ea. ....
.... Computavoice @ £7.95 ea. ....
.... Graphic Animator @ £7.95 ea. ....
.... Mazerace @ £7.95 ea. ....

Name ....

Address ....

....

I enclose Cheque/P.O. for £ ....
or, please debit my Access/Barclaycard No.

(continued from page 77)

Routine 1 will fill the whole screen with a specified character if you,

POKE START + 21

with the code of that character. It must be a non-expanded one — that is, not

RND, PI; INPUT etc.

Repeatedly calling routine 2 — for example within a For-Next loop — appears to flash the whole screen. The following Basic program would flash the screen until a key was pressed:

```
100 RAND USR 16514
110 IF INKEY$<>""THEN GOTO 130
120 GOTO 100
130 rest of program . . .
```

```
1  REM XXXX enough for all the machine code XXXX
10 LET X=16514
20 LET X$=""
30 IF X$="" THEN INPUT X$
40 IF X$="S" THEN STOP
50 POKE X, 16*CODE X$ + CODE X$(2) - 476
60 LET X=X+1
70 LET X$=X$(3 TO)
80 GOTO 30
```

Program 1.

Length 25 bytes

ld hl, (Dfile)	START	2A0C40
ld de, (Vars)		ED5B1040
ld b,h	NEXT	44
ld c,l		4D
and a		A7
sbc hl,de		ED52
ret z		C8
ld h,b		60
ld l,c		69
ld a, (hl)		7E
cp 76h		FE76
jr z, INC		2802
ld(hl), 0		3600
inc hl	INC	23
jr NEXT		18EE

Routine 1. A fast clear screen.

Length 26 bytes

ld hl, (Dfile)	START	2A 0C 40
ld de, (Vars)		ED 5B 10 40
ld b,h	NEXT	44
ld l,c		4D
and a		A7
sbc hl,de		ED 52
ret z		C8
ld h,b		60
ld l,c		69
ld a, (hl)		7E
cp 76h		FE 76
jr z, INC		28 03
add a, 80h		C6 80
ld (hl), a		77
inc hl	INC	23
jr NEXT		18 ED

Routine 2. Invert the screen.

Length 31 bytes

ld a, CHR	START	3E 00
ld hl, (Dfile)		2A 0C 40
ld b, 20h		06 20
inc hl	TOP	23
ld (hl), a		77
djnz, TOP		10 FC
ld b, 14h		06 14
inc hl	ENDS	23
inc hl		23
ld (hl), a		77
ld de, 001F		11 1F 00
add hl, de		19
ld (hl), a		77
djnz, ENDS		10 F6
inc hl		23
ld b, 20h		06 20
inc hl	BOT	23
ld (hl), a		77
djnz, BOT		10 FC
ret		C9

POKE START+1, CODE OF CHR to be printed.

Routine 3. Draw a border.

Length 28 bytes

ld a, LINE	START	3E 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ld b, 20h		06 20
inc hl	INC	23
ld (hl), 0		36 00
djnz, INC		10 FB
ret		C9

POKE START+1, line number to be cleared (0 to 21).

Routine 4. Clear single lines.

Length 33 bytes

ld a, LINE	START	3E 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
inc hl		23
ld d, h		54
ld e, l		5D
ld a, (hl)		7E
inc hl		23
ld bc, 001F		01 1F 00
ldir		ED B0
dec hl		2B
ld (hl), a		77
ret		C9

POKE START+1, line number to be scrolled (0 to 21).

Routine 5. Scroll a line to the left.

Length 55 bytes

ld a, LINE	START	3E 00
ld (4040), a		FD 77 40
ld (4029), 0		FD 36 39 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ld (DF.CC), hl		22 0E 40
inc (DF.CC)		FD 34 0E
ld de, (Vars)		ED 5B 10 40
inc hl	NEXT	23
ld b, h		44
ld c, l		4D
and a		A7
sbc hl, de		ED 52
ret z		C8
ld h, b		60
ld l, c		69
ld a, (hl)		7E
cp 76h		FE 76
jr z, NEXT		28 F2
ld (hl), 0		36 00
jr NEXT		18 EE

POKE START+1, line number to CLS from (0 to 21).

Routine 6. Clear down from a given line.

Length 28 bytes

ld bc, 014A	START	01 4A 01
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ex de, hl		EB
ld bc, 0168		01 68 01
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ldir		ED B0
ld b, 20h		06 20
dec hl	CLR	2B
ld (hl), 0		36 00
djnz, CLR		10 FB
ld bc, 0015		01 15 00
ret		C9

Call with PRINT AT USR START, 0; " up to 32 characters "

Routine 7. Scroll bottom 12 lines only.

(continued on next page)

(continued from page 79)

Length 53 bytes

ld a, LINE	START	3E 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
inc hl		23
ld bc, COLUMN		01 00 00
add hl, bc		09
ld d, FLASH		16 00
ld c, (hl)		7E
ld (hl), 0	GO	36 00
ld c, 0		0E 00
ld b, OFF	DLA2	06 00
djnz, DLA1	DLA1	10 FE
dec c		0D
jr nz, DLA2		20 F9
ld (hl), a		77
ld c, 0		0E 00
ld b, ON	DLA4	06 00
djnz, DLA3	DLA3	10 FE
dec c		0D
jr nz, DLA4		20 F9
dec d		15
jr nz, GO		20 E8
ret		C9

POKE START+1, Line number of character

POKE START+22, Column number of character

POKE START+26, Number of flashes (0 to 255)

POKE START+33, Time off (0 to 255)

POKE START+43, Time on (0 to 255)

Routine 8. Flash a single character.

Length 67 bytes

ld a, LINE	START	3E 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ld d, FLASH		16 00
ld b, 20h	GO	06 20
inc hl	INC	23
ld a, (hl)		7E
push af		F5
djnz, INC		10 FB
push hl		E5
ld b, 20h		06 20
ld (hl), 0	OUT	36 00
dec hl		2B
djnz, OUT		10 FB
ld c, 0		0E 00
ld b, OFF	DLA2	06 00
djnz, DLA1	DLA1	10 FE
dec c		0D
jr nz, DLA2		20 F9
pop hl		E1
ld b, 20h		06 20
pop af	IN	F1
ld (hl), a		77
dec hl		2B
djnz, IN		10 FB
ld c, 0		0E 00
ld b, ON	DLA4	06 00
djnz, DLA3	DLA3	10 FE
dec c		0D
jr nz, DLA4		20 F9
dec d		15
jr nz, GO		20 D4
ret		C9

POKE START+1, Line number to be flashed

POKE START+21, Number of flashes (0 to 255)

POKE START+38, Time off (0 to 255)

POKE START+57, Time on (0 to 255)

Routine 9. Flash a single line.

Length 13 bytes

ld hl, 0000	START	21 00 00
add hl, sp		39
ld de, (Stk end)		ED 5B 1C 40
sbc hl, de		ED 52
ld b, h		44
ld c, l		4D
ret		C9

PRINT USR START gives number of free bytes remaining in memory

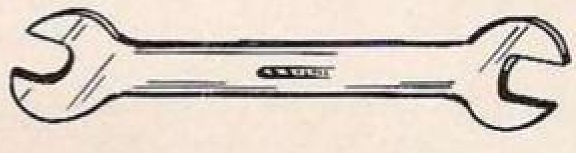
Routine 10. Remaining memory.

Length 26 bytes

ld hl, (Dfile)	START	2A 0C 40
ld de, 02D6		11 D6 02
add hl, de		19
ex de, hl		EB
ld hl, (Dfile)		2A 0C 40
ld bc, 02B5		01 B5 02
add hl, bc		09
lddr		ED B8
ld bc, 2000		01 00 20
inc hl	INC	23
ld (hl), 0		36 00
djnz, INC		10 FB
ret		C9

Call with PRINT AT USR START, 0; " up to 32 characters "

Routine 11. Reverse scroll.



Length 62 bytes

ld a, LINE	START	3E 00
call stack a		CD 1D 15
ld a, 21h		3E 21
call stack a		CD 1D 15
rst 28		EF
multiply		04 34
call unstack		CD A7 0E
ld hl, (Dfile)		2A 0C 40
add hl, bc		09
ld d, FLASH		16 00
ld b, 20	GO	06 20
inc hl	INC	23
ld a, (hl)		7E
add a, 80h		C6 80
ld (hl), a		77
djnz, INC		10 F9
ld c, 0		0E 00
ld b, OFF	DLA2	06 00
djnz, DLA1	DLA1	10 FE
dec c		0D
jr nz, DLA2		20 F9
ld b, 20h		06 20
ld a, (hl)	BACK	7E
add a, 80h		C6 80
ld (hl), a		77
dec hl		2B
djnz, BACK		10 F9
ld c, 0		0E 00
ld b, ON	DLA4	06 00
djnz, DLA3	DLA3	10 FE
dec c		0D
jr nz, DLA4		20 F9
dec d		15
jr nz, GO		20 D9
ret		C9

POKE START+1, Line number to flash

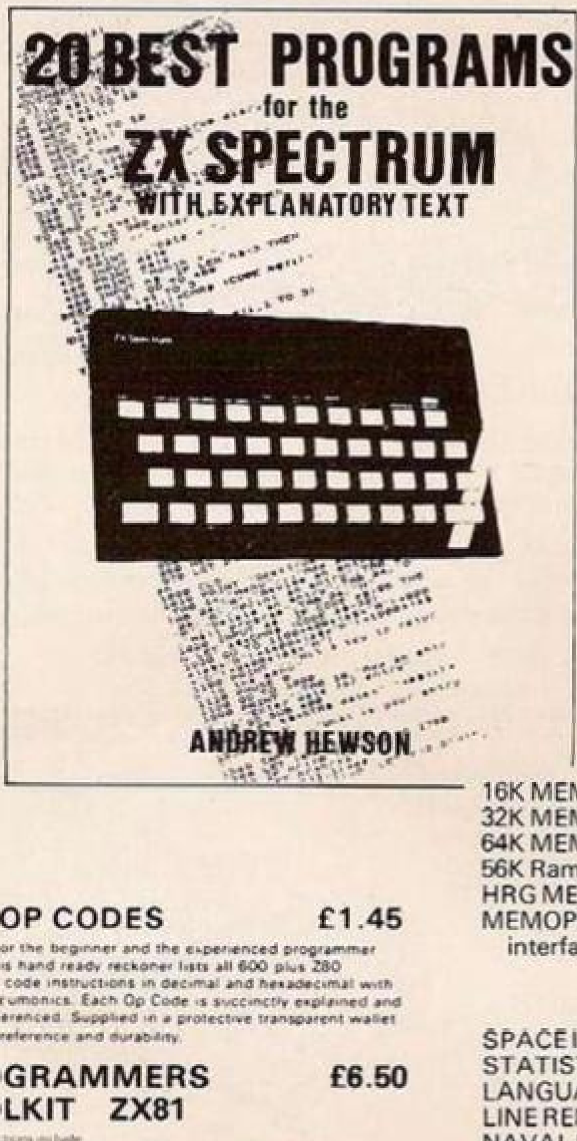
POKE START+21, Number of flashes (0 to 255)

POKE START+34, Time off (0 to 255)

POKE START+52, Time on (0 to 255)

Routine 12. Flash a line in inverse.

20 BEST PROGRAMS for the ZX SPECTRUM £7.95



Mr HELPLINE — the man who answers your ZX queries in his column in *Sinclair User*, the author of HINTS & TIPS FOR THE ZX80 and HINTS & TIPS FOR THE ZX81 now presents his 20 BEST PROGRAMS FOR THE ZX SPECTRUM.

* 20 original programs for you to load into your Spectrum.
* 20 interesting programs for you to enjoy and learn from.
* 20 great programs to teach you about fixed and variable length records, binary searches, bubble sorts, floating point arithmetic, graphic displays and much, much more . . .
* **20 BEST PROGRAMS FOR THE ZX SPECTRUM.**

Program Titles Include:

Machine code editor — Write, modify, exend and load machine code using this all-Basic machine code editor. No need to use an Assembler when you have this program.

Index file — Learn about fixed length records, save numeric and string fields, add to, sort, modify, delete and print your records. Ideal as a computer based card index.

Duckshoot — Learn how to manipulate the attribute file *and* have fun at the same time.

Diary — Binary searches and variable record lengths are explained with this useful and interesting program.

PLUS: FOOTBALL, DIGITISER, DATA PLOT, FUNCTION PLOT, REGRESSION, HISTOGRAM, LINE RENUMBER and many more.

Z80 OP CODES £1.45

A must for the beginner and the experienced programmer alike. This hand ready reckoner lists all 600 plus Z80 machine code instructions in decimal and hexadecimal with their mnemonics. Each Op Code is succinctly explained and cross-referenced. Supplied in a protective transparent wallet for easy reference and durability.

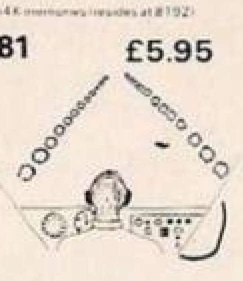
PROGRAMMERS TOOLKIT ZX81 £6.50

Toolkit functions include

* RENUMBER including the destination lines of GOTO's and GOSUB's. START and finish lines and Step size specified by you
* DELETE part or all of a program at your command
* REPLACE characters (or tokens) with an equal number of others specified by you
* EDIT to creat sub-routines at a stroke by moving blocks of basic program lines
* FIND a basic program string specified by you
* INPUT prompts for a two-digit hexadecimal code and pokes it in at a specified address
* Separate version available for 4K + 8 and 64K memories (resides at 8192)

PILOT ★ ZX81 £5.95

New and exciting Pilot challenges you to take off, fly between beacons then land whilst watching wind speed and dodging craggy mountains — either could lead to disaster! If you take the challenge, you may soon learn to fly solo — so detailed are the flying instructions. Coast along in Autopilot just to gain confidence, then battle your way through 6 further modes, 6 different ways of trying to steer your plane safely back to base, increasing in difficulty, testing your skills. Good luck with your fight against the unpredictable elements!



PUCKMAN *NEW!* ZX81 £5.95

* All action display
* Scour the maze for food
* Dodge the ghosts who come to devour you
* Automatic option — the machine plays itself
* Full keyboard display
* Full instruction display
* Continuous scoring
* Beat the best score to date
* Super graphics when used with Quick Silva graphics board



ZX81 HARDWARE

16K MEMOPAK (expandable)	£29.90
32K MEMOPAK (expandable)	£49.90
64K MEMOPAK	£79.00
56K Ram pack	£54.95
HRG MEMOPAK Hi Res Graphics	£59.80
MEMOPAK Centronics printer interface	£39.90

ZX81 CASSETTES

SPACE INTRUDERS (16K)	£5.95
STATISTICS (1K)	£3.75
LANGUAGE DICTIONARY (16K)	£3.75
LINE RENUMBER (16K)	£4.95
NAVAL BLOCKADE (16K)	£5.95

ZX81 BOOKS

HINTS & TIPS for the ZX81 £3.95

SPECTRUM

ASSEMBLER/DISASSEMBLER £8.95

* Two programs on one cassette
* Comprehensive instructions
* Great value for money

NIGHT FLIGHT £5.95

For the 16K or 48K SPECTRUM



Fly your own aircraft from take off to landing via navigational beacons, over mountains and using a fully detailed direction finding and instrument landing system. *You are the Pilot of a light aircraft flying at night. *You must use your skill and judgment to fly your aircraft accurately over radio beacons and then land safely on the runway *Hazards are mountains and cross winds *Instruments: Artificial Horizon, Non Directional Beacon, VHF Omnidirectional Range, Instrument Landing System *Readouts: Gear, Flap, Air Speed, Distance Measuring Equipment, Vertical Speed, RPM and heading *Visual display of runway on approach *5 Modes from Take off to Autopilot *Happy landings *WRITTEN BY A QUALIFIED PILOT*

QUANTITY	PRODUCT	COST
	TOTAL	

MAKE CHEQUES/PO's PAYABLE TO: HEWSON CONSULTANTS.

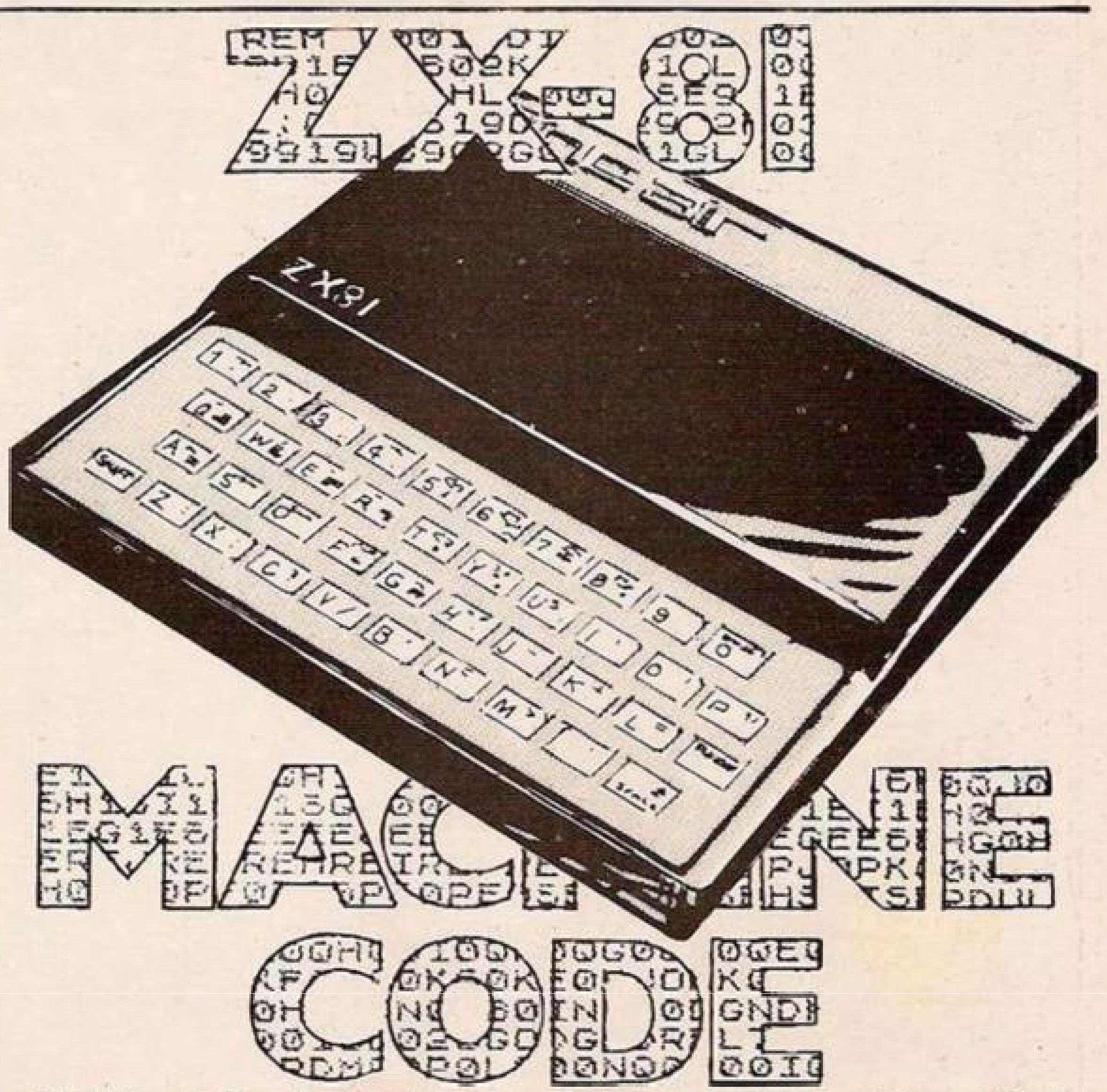
NAME ....
(block capitals please)
ADDRESS ....

....

My Access/Barclaycard No. is ....

Signed ....

Post to: **HEWSON CONSULTANTS, DEPT YC, 60A ST MARY'S STREET, WALLINGFORD, OXON OX10 0EL. TEL (0491) 36307.**



Kathleen Peel reveals some rather more problematical commands, which would have introduced unnecessary difficulties if mentioned earlier. These will enhance commands covered in the previous instalments of her machine-code series.

EXTENSIONS

THESE COMMANDS have been left until last because of the problems they can create if not used carefully. Problems are the last thing you require when dealing with machine code.

This small group of commands is, for the most part, either extensions to previous commands or special operational commands.

Dealing with the extensions first, I previously stated that A was the only variable to which one of the other variables could be added or subtracted. It is also possible to add or subtract a constant.

Basic	Mnemonic	Machine code
LET A=A+52	ADD A N	198 N
LET A=A−32	SUB A N	214 N

Remember A is single variable so that the constant has to be in the range of 0 to 255.

In the first article we mentioned the F variable, flag, and said that after certain operations it was tested for zero. In fact it is tested for rather more than that.

If the A variable is less than the value of the variable or constant with which you are comparing or operating then the flag variable C, carry, is set.

If the A variable is greater than, or equal to, the value of the variable or constant that you are comparing it with, then the flat variable NC, No Carry, is set.

In Basic terms where X is a constant or a variable:

Relation	Variable	Flags set
A=X	Z	NC
A<>X	NZ	can be either
A<X	C	NZ
A>=X	NC	can be either

Now you can use these additional flag-variable relationships with your jump commands.

JP	NC	DIS	48	N
JP	C	DIS	56	N
JP	NC	NN	210	NN
JP	C	NN	218	NN

We can also compare the contents of the A variable with either a constant or one of the other variables, code 184 to 190. The result of this will set flag variable Z if they are equal, or NZ if they are not, and the flag variable Carry, if A is less than the variable, and No Carry if not.

Basic	Mnemonic	Machine code
IF A=N THEN LET F=Z	CP N	255 N
IF A<>N THEN LET F=NZ		
IF A>=N THEN LET F=NC		
IF A<N THEN LET F=C		

Note that the flag variable can be considered as a string rather than a number. Thus it is capable of holding the string NZNC, that is, non-zero, No Carry, if A is greater than the compared variable.

There is a group of commands similar to JP known as Call commands. The difference is that when you Call a return address is Pushed onto the stack. Later when a Ret instruction is met, the machine code Pops the return address off the stack and jumps to it.

```
CALL NN >>>>>INC B
        LD (HL) B
LD B A <<<<<RET
```

Great care must be exercised when using Push, Pop and nested Calls, so that return addresses are not mixed up with Pushed and Popped variables.

Should your machine-code program ever fail to work, look at this first and ensure that for every Push there is a Pop within a subroutine, and that you have not Popped your return at the beginning of your subroutine.

Main Program	Subroutine
PUSH HL	LD A N
CAL NN	POP H L
:	:
:	:
	RET

Pop HL pulls the return address off the stack, not the Pushed HL. Remember, Pop pulls off the last variable pushed.

The Call routines can be made by the same relationships as Jumps.

CALL	NN	205	N	N
CALL NC	NN	212	N	N
CALL C	NN	220	N	N
CALL NZ	NN	196	N	N
CALL Z	NN	204	N	N

Now for some special functions that you may encounter.

XOR A

There is a simple way of making the A variable equal to zero — LD A 0 — and that is to use the mnemonic XOR A, Code 175.

EX DE HL

More can be done with the HL variable pair than with the DE pair. We can load a constant into HL, or any of the other variables. It is useful to be able to exchange the contents of DE and HL. The mnemonic is EX DE HL, Code 235.

AND A

With the Sinclair character code, the difference between a character and its inverse is 128. See page 181 of the Sinclair manual.

Therefore, if we just wish to know a character and not worry about its colour then by using the A variable we can mask off the colour by using the command And N, Code 230.

And 127 blocks out the colour and just leaves the character, And 128 blocks out the character and just leaves the colour.

BIT 7A

A related command is Bit 7, A, Code 203 127. This tests to see whether the 128 part of the character is there and sets the flag variable NZ if it is and Z if it is not.

This command does not alter the A variable, it only tests it and sets up the flag variable according to the result.

Next month *Your Computer* begins a series of articles on machine-code chess. The range of code used has now been covered by the machine-code articles and this supplement. You will see how machine code can be used to produce fast compact programs. ■

ANNOUNCING The BEST Books For Your SPECTRUM



Dr. Logan is acknowledged as the leading authority on Sinclair computers. In his book, he gives you a complete overview of the way the Spectrum operates, both for BASIC and machine language programming, including numerous demonstration programs. In Dr. Logan's own words UNDERSTANDING YOUR SPECTRUM has three main aims: "*to explain, in simple terms, how the Spectrum works; *to teach Z80 machine code from first principles; and *to give details of 'monitor entry points' so that efficient programs can be written." Plus a special section on the ROM operating system. This book is a must if you are serious about programming the Spectrum. **£7.95**

A book to amaze you! With the full listings of over 30 programs for your Spectrum you will find ready-made professional programs whatever your interest or application. Listings are printed in a specially designed easy-to-read format and each program has detailed notes. You'll find exciting arcade favourites, strategy games, utilities, business and educational programs, plus programming hints, tips on extending the Spectrum, and more, which all combine to make this the definitive book for every Spectrum user. Incredible value – over 160 pages including 8 pages in full colour. **£6.95**

If you are frustrated by the limitations of BASIC and want to write faster, more powerful, space-saving programs or subroutines, then SPECTRUM MACHINE LANGUAGE FOR THE ABSOLUTE BEGINNER is the book for you. Even with no experience, you will be able to discover the ease and power of the Spectrum's own language. Each chapter includes specific examples of machine language applications. At the end of the book, all this is brought together into an entire machine language program – from design right through to the complete listing of an exciting, original arcade game. **£6.95**

After leading the way in Sinclair ZX81 software, we've produced the highest quality, most exciting Spectrum software available. From the three excellent books depicted above to fast-action games on cassette, we're providing the best choice in Sinclair Spectrum software today.

Now on cassette all the programs from the Over The Spectrum book! **Cassette 1** includes *Lunar Lander, 3D-Mazeman, Chess* and 7 more; **Cassette 2** has 9 programs including utilities, *Eliminator, Freeway Frog* and a full scale *Adventure*. **Cassette 3** includes *Sales Analysis, Payroll, Spectrum Invaders, Meteor Storm* plus 5 others. Each cassette is **only £5.95** including V.A.T.

Melbourne House Publishers,
Orders to: 131 Trafalgar Road, Greenwich, London SE10.
Correspondence to: Glebe Cottage, Station Rd., Cheddington, Leighton Buzzard, BEDS LU7 7NA.

- ☐ Please send me your Spectrum catalogue

Please send me:

- ☐ Understanding Your Spectrum Book @ £7.95
- ☐ Over The Spectrum Book @ £6.95
- ☐ Spectrum Machine Language For The Absolute Beginner Book @ £6.95
- ☐ Over The Spectrum Cassette No. 1 @ £5.95
- ☐ Over The Spectrum Cassette No. 2 @ £5.95
- ☐ Over The Spectrum Cassette No. 3 @ £5.95

(please add 80p for post, pack & VAT)

Name..

Address..

.... Post Code YC11

MELBOURNE HOUSE PUBLISHERS

AWARI

Can
You beat
the MONSTER
????????????????

You could win £100 by playing one of the oldest games in the world.

Compete with the Rabbit, Beast or Monster to get the beans in your bowl. SIMPLE??

Try it! Send £6.95 today and £100 could be yours. Please allow 14 days delivery.

GOOD LUCK!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

FOR ZX81 16K.

UNDERSTANDING LIMITED
MICRO-COMPUTER SERVICES
The Production Village
100 Cricklewood Lane London NW2 2DS

GUARANTEED PROGRAMS FOR ZX81 AND SPECTRUM

ZX81 SPECTRUM & ACORN USERS:



TRIED & TESTED PROGRAMS FOR ZX81 & SPECTRUM

More Real Applications for the ZX81 and Spectrum
by Randle Hurley. (£7.50 – plus cassettes for ZX81 or Spectrum for £9.00 each inc. VAT)
Bug-free programs to turn your ZX81 or Spectrum into a small business or working computer that include:
• File Handling Survival Kit • Cash Register Program
• Statistics – with 16K Storage • Animation Package for games and simulations • Crashproofing and User Friendliness • Menu Driven Programs.

FOR ONLY £7.50

Assembly Language Programming for the BBC Micro-Computer by Ian Birnbaum (£8.95 – plus 2 cassettes for £16.00 inc. VAT).
INCREASE THE CAPABILITY OF YOUR BCC MICRO-COMPUTER
Learn how to run your BBC micro-computer faster. This book is a complete education in assembly language that includes:
•Conditional Statements • Loop Structures • Arrays • Macros
• Inputting Strings • The Stack
Specially designed double tapes contain all the programmes shown in the book – saves time and effort.

FOR ONLY £8.95

GLOBE BOOK SERVICES LTD
To: Ian Jacobs, Globe Book Services Ltd.
FREEPOST, Canada Road, Byfleet, Surrey KT14 7JL.
Please send:

☐ More Real Applications for the ZX81 and Spectrum (£7.50).
☐ ZX81 Cassette (£9.00). ☐ Spectrum Cassette (£9.00).
☐ Assembly Language Programming for the BBC Micro-Computer (£8.95).
☐ Double Cassette (£16.00).
Cheque enclosed for £ ________ (p&p 75p per order).
NAME ________
ADDRESS ________

Guarantee: Return for full refund in 14 days if not delighted. 2

NEW SPECTRUM SOFTWARE

JACKPOT FRUIT MACHINE
Featuring holds, nudges and realistic hi. res. symbols. Colourful – just like the real thing!
Plus

SUBMARINE ATTACK
Destroy them before they destroy you. Fantastic fast action fun. Both games just £4.95, 48 K SPECTRUM.

Boldly Go where no Spectrum has gone before... in
SUPER SPACE MISSION
Incredibly fast machine code graphics. Dodge the swooping aliens and meteors. Fight exciting multi directional laser battles from your moving starship. Really exceptional graphics, seven skill levels, only £4.95 for 16 or 48K SPECTRUM or 16K ZX81.

MONSTER MINE
Escape from the depths of the legendary El Dorado mine by dodging the monsters and collecting the golden nuggets. Full machine code. Only £4.95 for 16 or 48K SPECTRUM or 16K ZX81.



Richard Shepherd Software
FREEPOST (No stamp required),
MAIDENHEAD,
BERKS, SL6 5BY.

Promotion's the name of the game in 'SHIP OF THE LINE' – An adventurous management game. Fearlessly battle your way up the ranks... encounter enemy fleets... survive mutiny, fever and famine... endure fog, fire and thirst... then when you think you've done well... rush home to Port for promotion!
16K SPECTRUM £4.95 48K SPECTRUM £6.50.

MULTI FUNCTION CASH CONTROLLER
Takes care of your Home Budgeting, Bank Account, Standing Orders, Loan and Mortgage Repayments. Complete security ensured by secret password. A budgeting bargain for only £10.
48K SPECTRUM.

'SHAKEN BUT NOT STIRRED!'
A James Bond 007 Adventure.
Recover a stolen warhead from the lair of Dr. Death, but first follow the trail across continents, locate his secret island, encounter the steel fisted giant Paws, then find yourself in his underwater maze and hopefully find the missile... But It Doesn't End There!
Can you resist being 007? Only £6.50 48K SPECTRUM.

ORDER FORM Please send me:

______	Jackpot/Sub. Attack	at	£4.95
______	Space Mission	at	£4.95
______	Monster Mine	at	£4.95
______	16K 'Ship of the Line'	at	£4.95
______	48K 'Ship of the Line'	at	£6.50
______	48K 'Shaken but not Stirred!'	at	£6.50
______	48K Multifunction Cash Controller	at	£10.00

OFFER!
Buy 2 get £1 off
Buy 3 get £2 off
Buy 4 get £3 off

By First Class Post On Quality TDK Cassettes

ORDER BY DECEMBER 15th — RECEIVE BY XMAS

I enclose my cheque/Postal Order for £ ....
payable to Richard Shepherd

Name ....

Address ....

Machine .... ______ K Memory

The new Dragon 32. So well designed, you'll even understand this ad.

If you're already a computer expert, may we refer you to the box of technical specifications displayed opposite.

If you're not, may we refer you to the new Dragon 32 Family Computer. A computer so easy to understand, you won't understand why all the others seem so difficult.

And the new Dragon 32 costs under £200.

32K RAM FOR UNDER £200?*

When you're comparing computers, the first thing you need to know is the size of the memory. In plain English, the Dragon has approximately 32 thousand units of Random Access Memory. (32K RAM for those who prefer to be blinded by science.) This means that the Dragon's memory is at least twice as powerful as its competitors'.

With a memory this powerful, the amount of information the Dragon can store is literally vast. But the Dragon doesn't just make it easy to store information. It makes it easy to use, too.

USER-FRIENDLY?

You may have heard of the term 'user-friendly.' Reverting to plain English once more, this means simply that the computer will go out of its way to understand you, rather than vice-versa.

The Dragon 32 is so user-friendly, it practically licks your hand.

You tap (literally) its vast resources through a beautifully-designed keyboard that's as easy to use as a typewriter.

On this keyboard, you type in a language which is surprisingly close to the English you talk every day. The Dragon 32 will receive your order. Understand it. Send it to the appropriate section of its massive brain. And then display the appropriate information on your screen. All before you can say 'gobbledy-gook.'



*TV not included in price.

SPECIFICATIONS
6809E MICROPROCESSOR. Pet, Apple, Atari 400, BBC Micro, and VIC 20 still have the less powerful 6502.
32K RAM (as standard). At least twice the power of similarly priced machines. Expandable to 64K RAM.
EXTENDED MICROSOFT COLOUR BASIC (as standard). Featuring: ADVANCED GRAPHICS (set, line, circle, paint, print, draw, rotate and print using). ADVANCED SOUND 5 octaves, 255 tones. AUTOMATIC CASSETTE RECORDER CONTROL. FULL EDITING with INSERT and DELETE.
9 COLOUR, 5 RESOLUTION DISPLAY.
USE WITH ANY U.H.F. TV and/or separate P.A.L. monitor.
PROFESSIONAL QUALITY KEYBOARD. Typewriter feel. Guaranteed for 20 million depressions.
PRINTER (Centronics parallel).
JOYSTICK CONTROL PORTS.

FEATURE \ PRODUCT	DRAGON 32	SINCLAIR SPECTRUM	ACORN ATOM	VIC 20	TI 99/4A	BBC MICRO 'A'
PRICE	£199	£125	£175	£190	£199	£300
STANDARD RAM SIZE	32K	16K	8K	5K	16K	16K
STANDARD AVAILABLE RAM FOR HIGH RESOLUTION GRAPHICS	26K	9K	N/A	N/A	14K	3K
EXTENDED MICROSOFT BASIC AS STANDARD	YES	NO	NO	NO	NO	NO
PROFESSIONAL-TYPE KEYBOARD	YES	NO	YES	YES	YES	YES

FIRE YOUR IMAGINATION.

Learning how to use the Dragon 32 won't cause you to experience any problems. Learning what you can use it for will cause you to experience something entirely different.

Delight. Surprise. Fascination. And challenge.

The Dragon offers a range of some of the most popular computer games in the world. From those celebrated space battles to mind-boggling adventures in seemingly unfathomable dungeons and caves.

As if by magic, a simple typed message will command the Dragon to create your own drawings. Then it will colour and paint them in 9 colours.

And it's clever enough to create virtually any image you want - circles and arcs as well as straight lines.

The Dragon will also play and compose music with you, with a range of 5 octaves. And it works with any UHF TV or PAL monitor.

LEARNING THROUGH PLAYING.

All of this makes the Dragon the ideal machine to build your children's interest in the world of computers as they become increasingly more vital. School-children already enjoy using computers.

The Dragon is the first computer specifically for the family - so by enjoying yourselves at home, you and your children can soon become expert enough to create your own programs.

BRILLIANTLY SIMPLE GUIDE.

The Dragon is living proof that you don't have to be an expert in computerspeak to be an expert in computers. It comes with the easiest-to-understand instruction manual ever written for a home computer.

Every step, every explanation, is made clear - even if you're a beginner. In minutes, it will show you how to write a simple program. Within hours, you'll be fascinated. And from then on, you'll continue to be astounded by the new world which the Dragon's power and versatility will open up to you.

See the new Dragon 32 in your High Street. At under £200, it's not just the first family computer. It also has all the features an expert could wish for.

Except perhaps the jargon.

DRAGON 32
The first family computer.

To: Jean Webster, Dragon Data Ltd, Queensway, Swansea Industrial Estate, Swansea, Glamorgan SA5 4EH.
Tel: 0792 580651.

Please send me further information about the Dragon 32.

Name ______________________

Address ______________________

____

______________________ YC

A member of the Mettoy Group of Companies.

PROJECT

SIMPLE WAYS TO HANDICAP

John Dawson casts a clinical eye over the winning entries in our competition to help the disabled.

JOHN HEATH has won an Epson MX80F/T printer for a simple, but powerful device for putting information into a Sinclair Spectrum computer. Tony Higham, who is 17 years old, wrote a program to allow a disabled person to write Basic programs on the Tangerine Microtan computer, using only three keys or switches. He wins the under-18 section of the competition and will receive a BBC Micro. Sinclair Research has generously donated three ZX-81 computers as special merit prizes.

The competition rules stated that, in the under-18 section, we were looking for original and stimulating ideas, aimed at the practical needs of someone handicapped in a particular way. In the over-18 competition, we hoped to see a working, prototype device with some associated software. The idea was to encourage people to think about mass production of their inventions. Bright ideas in isolation are of little use.

No-one doubts that handicapped people's lives can be enriched via micro-electronics, but a discouragingly long catalogue of factors has limited their widespread application. When he built the pneumatic switch for the Spectrum, John Heath was aware of these problems.

People who are handicapped are disadvantaged as wage-earners, and support for the disabled is never high on the list of priorities for governments.

Although there are many disabled people, there is a conflict between the need to supply cheap, mass-produced aids, and the wide range of individual disabilities.

It is usually essential to adapt aids to the particular needs of the individual. If the customisation involves a health-care professional, costs rise dramatically.

Safety aspects

Maintenance of specialised, complex equipment installed at widely-separated sites throughout the country is also very expensive.

Very high standards of safety are necessary for electrical devices to be operated by handicapped people, who may be caught off-balance more easily than an able person. If the equipment uses mains power, simple aspects of the design such as the cord grips that hold the mains input wire may become much more important if users ever put all their weight on the anchorage between the wire and the case.

Figure 1 shows how John Heath plans to get a signal from a handicapped person using a simple rubber bulb full of air. When the bulb is squeezed, there is an analogue change in pressure in the pipe leading from the bulb. The tube is connected at the computer end to an adaptor which terminates at a diaphragm. Mylar film about 0.2 mm thick is an ideal material for the diaphragm, providing bi-directional motion in response to pressure changes.

A short rod or flag is attached to the centre of the diaphragm. This can be made to obscure a silicon photo-diode proportionally to the position of the diaphragm. The source of illumination is an infra-red light-emitting diode (LED).

A person pressing on the bulb will cause the diaphragm to bulge, thus changing the current flowing through the photo-diode.

The change in current through the diode can be detected by various circuits. One low-cost method of digitising the photo-diode current is to allow it to discharge a capacitor, and to measure the discharge time which will be inverseley related to the current flowing through the diode.

Figure 1 shows how the software and hardware provide a binary on/off output from the changing pressure in the pneumatic actuator.

The computer is programmed to turn on an output Bit on one of the computer ports for a fixed period. The pulse provided by the computer charges the capacitor. During and after the pulse, the photo-diode discharges the capacitor, and the time that it takes for the voltage to reach a fixed low level, is determined by a program which reads in the input port continually, until it sees a signal that the Bit has dropped to the off — low level — state.

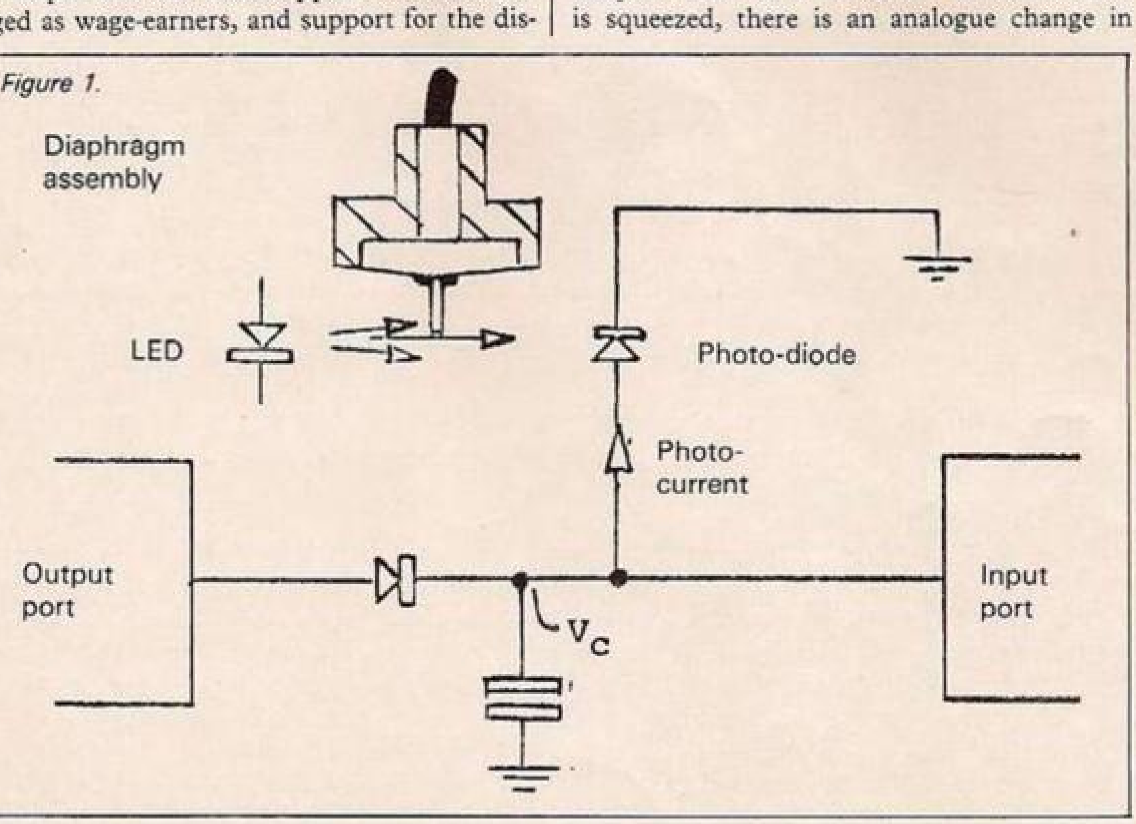
The input section of the program provides a digital measurement of the pressure in the tube by counting the number of times it has to go round in a loop while it waits for the state of the input latch to change.

Individual setting of the current flowing through the LED is necessary to compensate for variation in the sensitivity of the opto-electronic components, and the position of the components relative to the position of the rod attached to the diaphragm.

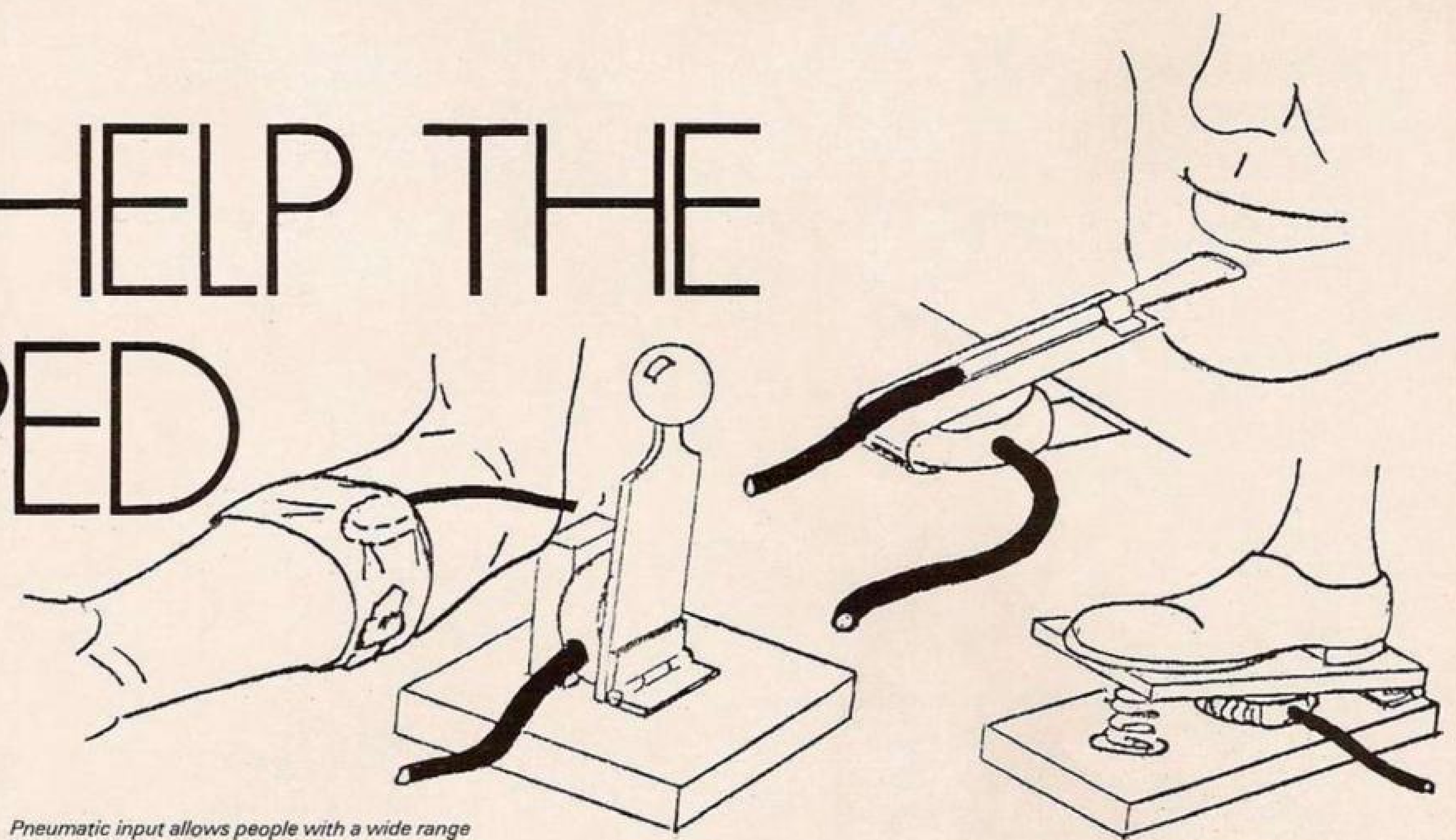
Existing devices for the handicapped are similar to other menu-driven data processing programs, in that the user controls the position of the cursor which moves among a selection of characters and commands.

John Heath's program makes the cursor go

Figure 1.



HELP THE
PED



Pneumatic input allows people with a wide range of disabilities to operate a computer.

forward by increasing the pressure in the tube, either by squeezing the bulb or by blowing into the tube. The user can choose commands by giving a short, hard puff down the tube in contrast to the lower steady pressure which makes the cursor move forwards. Because the pneumatic and opto-electronic parts of the switch are analogue components it is possible for the software to sense a range of pressures. This can be used to control the speed of the cursor. Negative pressure in the tube, caused by sucking, can be detected and used to move the cursor backwards.

John Heath found factors which were essential for the successful operation of the system. First, a significant margin must exist between the pressure giving fast cursor motion and the pressure that signals that a command or character is to be selected.

Secondly, when the user relaxes, the cursor velocity must fall to zero immediately if the user is to be able to operate the device at its fastest rate. Thirdly, the user should be able to adjust the response time of the system to suit the speed at which he or she can react. The speed at which a disabled person can use the system may vary from day to day, and the means of adjustment should be built into the software rather than designed as part of the hardware.

Keyboard aid

The program that 17-year old Tony Higham wrote was designed to help handicapped people to program a computer in Basic. He said that the program was to be used with a joy-stick or some other device to make operation easier for a disabled person.

When you run the program, the top-half of the screen displays a set of letters and commands which simulate the ordinary keyboard. Three keys control the movement of a cursor.

4 Move cursor to the left
6 Move cursor to the right
5 Select the letter or command beneath the cursor

Pressing the key to move the cursor to the right will transfer the cursor from the end of one line to the beginning of the next. When you select a character by pressing key 5, the letter appears on the bottom line of the screen and an asterisk character marks the point where the next character will be displayed. The user can select any of the keyboard functions, such as Return or Delete by positioning the cursor over the simulated Return or Delete keys.

Tony Higham built a shorthand command function into his program to increase the Basic writing speed. To get into the shorthand command program, the user types an Escape character by placing the cursor over the simulated Escape key. The asterisk character, which acts as a cursor on the bottom line of the screen, is replaced by S and then the keyboard can be used as before. When the user enters a single letter command, the complete Basic instruction is displayed on the bottom line.

Paul Coker developed a computer program to help people cope with dyslexia. This is an inability to gain access to information and to transmit it effectively to other people. Dyslexics cannot remember accurately the order in which letters are set down to form words due to the information about a word's structure being jumbled up between their eyes and their long-term memory.

Using a dictionary to check spellings, due to the complexities of the English language, is not always possible. For example, words like Know and No.

To overcome the problem Paul Coker wrote a program which he calls a Reverse Dictionary. The program will search for a correctly-spelt version of a word entered by the user. The average time to find the right match for a word typed into the computer is eight seconds if the first letter is correct.

If the first letter is wrong, the computer — A ZX-81 with 64K RAM — will take up to two minutes to find the word. Paul Coker says that his ZX-81 program is limited to 1,000 words as the tape take over six minutes to Load from cassette. A larger program could be used easily in a faster machine.

Help for dyslexics

I have not seen this program in operation, but the structure of the program appears to be divergent: more than one word might be taken to be a correctly-spelt version of the incorrect keyboard entry.

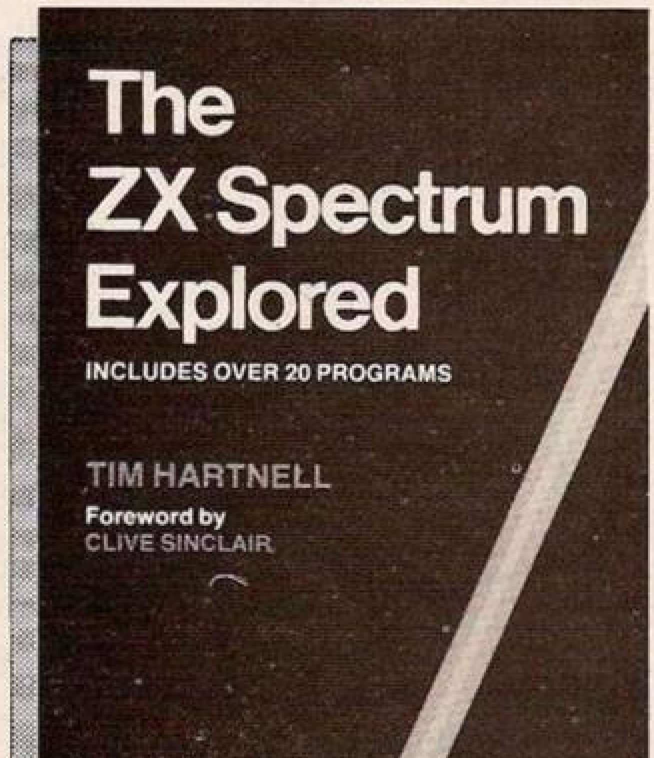
The single most telling point in this entry, and part of the reason why Paul won a special merit prize, is this: "My Reverse Dictionary is not meant to help a dyslexic to overcome the disability but to allow him or her to cope with it. The dictionary can be used in schools or colleges, but will be most useful at home where the person may not be able to get help with writing from a friend, and in cases where the writing is private."

I hope that as a result of the competition John Heath and Tony Higham will get together to combine their hardware and the software. Forth is a more powerful control language than Basic, allowing people who are handicapped to achieve a greater mastery of their environment. The health section of the IT 82 Committee will encourage the commercial assessment and development of the winning entries. ■

sinclair COMPUTERGUIDES

SB PUBLISHED BY SINCLAIR BROWNE LIMITED

The ZX Spectrum Explored



0 946195 00 5	approx. 220pp
October 1982	approx. £5.95/$11.65

INCLUDES OVER 20 PROGRAMS

by **Tim Hartnell,**
Editor of ZX Computing Magazine
Forward by **Clive Sinclair**

In this practical guide — with programs throughout — Tim Hartnell takes his readers from their first steps in programming to how the ZX Spectrum can be used as a tool at home, at work and for education. He looks at the use of sound, colour and 3D graphics, and shows how to write programs in BASIC, as well as how to use machine code on the ZX Spectrum.

The ZX Spectrum Explored is complete with many programs for education, business and — not least — pure fun!

Distributed by
John Wiley & Sons Limited
Baffins Lane · Chichester · Sussex PO19 1UD · England

BASIC DICTIONARY

This dictionary, compiled by Tony Edwards, will explain the function of common Basic words as used in popular machines, enabling you to work out your own machine's equivalent. A useful complement to our recent series on Basic dialect translation.

CLG A function to calculate the base 10 logarithm of its argument. The argument must be greater than 0. On the BBC Micro this is a statement which clears the graphics area of the screen and homes the graphics pointer to 0,0.

CLK This function returns the date and time. An argument is usually required but it is a dummy playing no part in the function.

CLK$ A similar function to CLK.

CLOAD A special command — which can also be used as a statement — found in Microsoft Basic. It loads a Basic program from a cassette. It is often followed by additional parameters identifying the cassette port and the program name.

CLOAD? Another Microsoft Basic command which verifies that the program stored in the memory is identical to that on a cassette tape. It may be followed by additional parameters identifying the cassette port and the program name.

CLOSE A statement used by many micros to close disc files. If no files are specified, it closes all files except in BBC Basic which uses CLOSE # 0 to close all files.

CLOG *See CLG*

CLR This may be used as a statement or a command and is used on the Pet and Apple II as an abbreviation for CLEAR. *See CLEAR*

CLS This is a command or a statement which clears the screen and homes the cursor without disturbing the program or variables. On the BBC Micro it only clears the text area of the screen. *See CLG*

CMD A command used by the Pet to control the IEEE device named by the argument.

CO An abbreviation of the CONT statement. *See CONT*

CODE The ZX series equivalent of ASC. Note however that these machines do not use standard ASCII Codes. *See ASC.*

COLOUR Also spelt COLOR on American machines. A command and a statement which identifies the code of the colour required to be used for output.

CON The Apple II abbreviation for CONT. *See CONT*

CONT A command used to restart a program which has been halted by BREAK or STOP. The program restarts from the point at which it has halted, with all variables intact.

COS A standard trig function which returns the cosine of the argument. The argument is normally in radians.

COUNT This is a BBC Basic function which returns the number of characters printed since the last new line.

CSAVE A special command — which can also be used as a statement — used by Microsoft Basic. It saves a Basic program on to a cassette. It must be followed by the program name and may also identify the cassette port.

CSNG A function which changes double-precision numbers and numeric variables to single precision. The double-precision value is not lost and can be recovered later.

D

D Used to indicate double precision when expressing numbers in standard scientific notation, exponential notation. For example:

1.23456789 D + 20

indicates

$1.23456789 \times 10^{20}$

D. An abbreviation for DATA.

DAT An abbreviation for DATA.

DATA A standard ANSI statement indicating that the rest of the line contains data to be read by a READ statement.

DEEK A similar statement to PEEK. It returns the value stored at the address indicated but in two adjacent addresses.

DEF FN A standard ANSI statement which allows the user to define his own functions. It can be simulated by using a subroutine which calculates the desired function.

DEFDBL A statement which defines the variables following it as double-precision variables, until redefined.

DEFINT A statement which defines the variables following it as integer variables, until redefined.

DEFSNG A statement which defines the variables following it as single precision variables, until redefined.

DEFSTER A statement which defines the variables following it as string variables until redefined.

DEG A command which causes trigonometrical functions to be operated in degrees rather than radians. It is also used as a function to convert radians to degree on some computers, including the BBC Micro.

DEL An abbreviation for the DELETE command.

DELETE A command which erases specified lines from the computer's memory.

DIM A standard ANSI statement which is used to specify the size and format of an array variable.

DIV A special function used by the BBC Micro which returns the integer quotient of two variables, or expressions, which themselves need not be integers.

DO . . . UNTIL A statement pair which causes a loop of statements following the Do to be implemented until the loop ends — that is, when the condition following the Until is satisfied. Control then passes to the statements on the following line. It can be faked with a For-To-Next loop. See *Your Computer* June 1982.

DOKE A similar statement to POKE but which places a two-byte value into adjacent memory locations.

DRAW This statement will draw a line from the current cursor position to a position specified by the co-ordinates following it, using the current foreground colour.

DRAW . . . AT This statement is used in Apple II Basic to draw the shape specified after DRAW in the position indicated after AT. The shape must have been previously defined and numbered.

DSP A statement used in debugging. It causes the line number and the value of variables indicated to be printed each time the program encounters them.

E

E Used to indicate exponential notation (standard scientific notation) for example: 1.01 E + 10 indicates the value 1.01×10^{10} *See also D.*

E. The Microsoft Level I Basic abbreviation for EDIT.

EDIT A widely-used command to call up the machine's Editor so that changes can be made in existing Basic lines. There are many different Editors and each has its own command vocabulary. This command is used as a direct command and only very rarely finds a use inside a program.

ELSE A statement used to redirect the program operation sequence when the condition specified for an IF-THEN statement is not met. It can be mimicked by additional statements, see *Your Computer* September 1982, page 64, program 2 for details.

END The statement used to terminate execution of the program. In some computers it must be the highest line-numbered statement, but in others it can appear anywhere in the program and multiple ENDs are allowed. It differs from STOP in that it returns control to the Basic interpreter whereas STOP returns to the command mode. An ANSI standard word — *See STOP.* ■

NEW
ZX SPECTRUM ROULETTE 48K

- Full colour Monte Carlo betting table on continuous display.
- Betting chip placement on table.
- Practically any bet can be placed.
- Suitable for 4 named players.
- Good linear simulation of peripheral wheel numbers with realistic slowing down.
- Ball jumps around before settling.
- All winning numbers, even money, column and dozen bets automatically flashed.
- Each player informed of any wins and bank accounts automatically credited.
- Sound effects.

Tapes including full instructions for play, and postage and packing, obtainable for £4.95, from: —

ZX SPECTRUM 16K COMPENDIUM OF CHILDREN'S GAMES

Tired of space invaders and games that go bang, bang? Make a change with Ludo, Snakes & Ladders, Beetle, Fox & Geese. No dice to lose or counters to pick up. Hours of family fun with these old-fashioned games updated for the space age. **£4.95** inc. P & P

SPECIAL OFFER
Both programmes on same cassette **£8.95**

DYMOND SOFTWARE,
22, HOSPITAL ROAD, ANNAN
DG12 5HP,
DUMFRIESSHIRE.

INTRODUCING FROM AMOLL TECHNICAL

ZX81 with 16K RAM

£5.45 inc P&P

PROGRAMMED & BLANK CASSETTES DELIVERY WITHIN A WEEK

Cassette 1 — BUSINESS MAN
This superbly interesting program will keep everybody from the most discerning company director to the tea-lady's grandchildren entertained for hours. Test your skill in the world of commerce. Make board room decisions on the future of your Company, on profit margins, manning levels, the Stock Market, in fact all the wheelings and dealings of the company executive.
A millionaire in 3 to 5 years? Or will you be calling in the receivers? Find out by playing *BUSINESS MAN*.

Side 2 — STARS MICRO CLOCK KILLER TANK PICTURE PAGE AMOLL INFO

Cassette 2 — MICRO PROFESSOR
This program is ideal for teachers and parents.
Following the success of cassette 1 we now have a new exciting and educational quiz program for 1 to 4 players to test their general knowledge. Each player has 5 questions randomly selected from a store of over 200 and these can be altered to, added to, up to 300. MICRO PROFESSOR takes up the entire ZX81 memory with the 16K RAM pack.

Side 2
Devise up to 300 questions and answers of your own such as pop music, sport, art, science, in fact — anything at all.

I enclose cheque/postal order
£.................... in payment for:
Cassette 1 (5.45) ☐
Cassette 2 (5.45) ☐
Blank cassettes
(£3.65 per pack of 5) ☐
C5 C10 C12 C15
(enter no. required)
Index Cards
(£1.40 per pack of 20)
(enter no. of packs required) ☐
ALL prices include UK postage & packing

Send your order to:
AMOLL TECHNICAL, 56 BANKS ROAD, POOLE, DORSET.
MR/MRS/MISS ____________
ADDRESS ____________
____
____________ Tel ____________
Signed ____________
Date ____________

Crystal
Innovative ZX Software

MERCHANT OF VENUS (ZX81 + 16K RAM)

This absorbing graphics game combines the skill of 'Lunar Lander' with the judgement of 'Stock Market'. With your freighter you have the freedom of the skies above the cities and spaceports of Venus. Each area of the planet has its own market prices for goods and fuel and you must discover the most profitable routes to work. Careful trading can make your fortune, but beware — upkeep of your ship is expensive and poor landings could cost you heavily in repairs. Start trading today for only £5.95.

CRYSTAL MACHINE CODE (ZX81 + 16K RAM) MONITOR AND DISASSEMBLER

This comprehensive program takes all the effort out of entering, editing, debugging and running your machine code. Occupying less than 3½K above RAMTOP its features include:

- 19 one-touch 'keyword' commands
- A full editing system
- High speed LOAD and SAVE
- RUN with breakpoints
- A Hex-to-Decimal and Decimal-to-Hex converter
- Print, Tabulate and Copy blocks of memory
- Display and alter CPU registers

This essential aid for all machine code users is fully compatible with your BASIC programs and comes complete with a detailed instruction manual for only £8.95.

SYMMETRICAL CRYSTAL 1K GAMES TAPE

Simply the ultimate in 1K games. For flicker free fast action games all with on-screen scoring plus a challenging puzzle to solve:

ASTRAVOID Dodge the asteroids! Dock with Pods to refuel. How long can you survive?
INVADERS Blast the advancing aliens before they land. Full screen display.
BOMBER Flatten the rocky wastes below to clear a landing strip for your damaged plane. Special HI-SCORE feature plus full screen display.
SUPER SLALOM Can you beat the elusive 10 second barrier?
DUNGEON QUEST Dwarves, Trolls, Dragongs, Wizards and more! You must solve the hidden mysteries of the dungeon to free the imprisoned Princess.

Five great machine code programs for just £4.95.

Send sae for our latest catalogue
Please add £0.50 p&p and make cheques/ POs etc payable to

CRYSTAL COMPUTING
291-293 Station Road, Dunscroft
DONCASTER DN7 4DY

BIOPRINT

USE YOUR ZX PRINTER

Make ideal Christmas gifts for your relatives and friends who have everything!

Make a gift which is not only a calendar, but also a Biorhythm chart showing their cycles for every day of the year, all on beautiful Sinclair silver paper.

You need their birthdate, your ZX81, printer and BIOPRINT.
Also for Spectrum!
Buy BIOPRINT for £5.00 inc. from...

FM

FISHER-MARRIOTT SOFTWARE
9c Abbey Hill, Kenilworth. CV8 1LW

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

TV GRAPHICS

■ I own a ZX-80 and a ZX-81 which both work fine on a 14 in. black-and-white TV, but when I try them out on a remote control colour TV the picture is very grey and the graphics are unclear. Altering contrast and brightness brings little improvement. I am thinking of buying an Atari or Dragon with colour and sound, but I am reluctant to do so in case I cannot obtain a decent picture. Is the problem with Sinclair's machines, or the TV?

L Adrian,
Wallasey, Merseyside.

THE MOST likely problem is the ZX computers. Many do not produce an ideal picture on a colour television, although they work perfectly linked with a black and white set. To some extent the problem exists with all microcomputers. For example, my BBC Microcomputer works perfectly on my TV, but extremely poorly on a friend's set. You should not have problems with Atari or Dragon; there have been no reports regarding television-matching problems. Why not ask if you can have a demonstration of the computer on your own television?

POKE PROBLEM

■ I am the lucky owner of a Spectrum, but one problem causes me headaches. The display file, as you know, is a little weird. When trying to Poke characters to the screen I become lost.

Richard Baldwin,
Harefield Road, Maidenhead.

THERE IS NO simple answer. Why not stick with the Screens and Print At commands which do the job in a more simple manner?

COUNT THE DAYS

■ In your September Response Frame, Derek Chadwick asked for a routine for counting the days between specific dates. My subroutine does the job in three lines, most of the work being done by line 9530:

```
9500 REM DAY NUMBER ROUTINE
9510 LET M=VAL A$ (4 TO 5)
9520 LET Y=VAL A$ (7 TO )
9530 LET DAYNO=VAL A$ ( TO 2) +
     INT ((Y-1981) *365.3)+ (1 AND
     (M >=3 AND Y/4=INT
     (Y/4)))+(31 AND M=2) + (59
     AND M=3) + (90 AND M= 4) +
     (120 AND M=5) + (151 AND
     M=6) + (181 AND M=7) + (212
     AND M=8) + (243 AND M=9) +
     (273 AND M=10) + (304 AND
     M=11) + (334 AND M=12)
9540 RETURN
```

Line 9510 assigns the month number to variable M, line 9520 assigns the year number to Y. Line 9530 calculates the day number, using the first of January 1981 as a base, and allows for such things as leap years. The date must be entered as a string, A$, in the form 01.07.1982. I have found the routine useful in two ways. First, it can be used prior to sorting arrays into date order. Second, it can be used for Mr Chadwick's application. I have used it to calculate interest accumulated between two dates.

Gordon Clarke,
Ruislip, Middlesex.

THANKS VERY MUCH for your routine, Gordon. It is certainly compact, and looks fairly robust.

JOIN THE CLUB

■ I won a Vic-20 which I intend to expand to its full potential. However, I am having trouble finding out about peripherals. I am also interested in business software for the Vic. Where can I get some information on available products?

S Knye,
Kids Grove,
Stoke on Trent, Staffordshire.

COMMODORE HAVE recently organised Vicsoft, their own club for Vic users. It supplies information on a number of products and services, along with members' discounts. You can get details and a catalogue, by writing to Vicsoft, 818 Leigh Road, Trading Estate, Slough, Berkshire.

A GOOD READ

■ I have a Vic-20 which I received at the beginning of the year. I have learned some Basic from *Introduction to Basic 1*, but now I feel I have come to a stop in my programming. Please could you advise me.

David Murray,
Chelmsford, Essex.

ONE BOOK I would recommend is the *Vic-20 Programmer's Reference Guide*, published by Howard Sams, for £12.50. Other books on the Vic include my own *Getting Acquainted with your Vic-20*, which is a first-time users' guide to programming, and the games book *Symphony for a Melancholy Computer*. Mark Ramshaw's book *Zap! Pow! Boom!* which has 30 arcade games for the Vic-20 may prove of interest. *The Vic Revealed*, by Nick Hampshire, has been very popular. You can get it from your Vic dealer, or by mail.

VIC VOICE

■ I am a Vic-20 owner, and recently purchased a voice synthesiser. The notes on how to actually make it work using Read and Data statements are brief to say the least, but I have managed to incorporate it into many programs successfully. What I have been trying to do is allocate words or short phrases to certain keys, but either all the Data statements are read at once, or the first statement is read, no matter which key is pressed.

John Nicholls,
Kingsley, Northampton.

MICROSOFT BASIC includes the facilities of a selective Restore, which effectively acts as a pointer within lines of Data statements. What you need to do is incorporate the relevant Data statements for one word or phrase in only one line of Data. Then, to get just that line (if it was, say, line 2700) your key press will have to select a line saying Restore 2700 just before you Read. This should solve the problem. If you want it to stop Reading at a certain point, put a dummy value — like 999 — in the Data statement, which the Vic can use as a stop indicator.

ROUTINE ENQUIRY

■ Having bought a ZX-81 to increase my knowledge of computers, I soon mastered its Basic. I then decided to branch out into machine code using Toni Baker's *Mastering Machine Code on Your ZX-81* and have since then sold my ZX-81 and bought a Spectrum. I have made enquiries at various computer stores and have found out that both computers use the same machine code. What I would like to know is whether there are any books which give the addresses of the useful subroutines in the Spectrum ROM.

Zarek Langridge,
Whaddon, Hertfordshire.

TO MY KNOWLEDGE, such books do not yet exist. However, Melbourne House has a book planned by Ian Logan which discusses, among many other things, useful address of subroutines. Hilderbay has a booklet on making the most of the Spectrum ROM and I have received very favourable reports about this.

LIST LOOK

■ I have owned a ZX-81 for about a year now, and *Your Computer* has proved an invaluable source of information and inspiration for me. However, I have found several program listings difficult to read. One example is the Landscape program by Gary Ownes in the September issue. It is very difficult to discern the difference between some of the numbers and letters, particularly 6, 8 and B in one of the strings. Also, I found the graphic characters in the Othello program in the June issue almost unreadable. Is there no better way of printing the listings, and if not, could a system of checking be introduced to ensure that at the final printing stages of the magazine, the listings can still be read?

Frank Warnes,
King's Lynn, Norfolk.

I AM GLAD that the magazine is proving a useful asset for your computing. The listing of programs is a constant problem for all computer magazines. It seems there are only two things that can be done. Either the listings can be reset, as the other material in the magazine is, and then printed, or a direct copy of the printout can be used. If the listing is set, it seems that no matter how well the proofs are read, errors will creep in. Using a direct printout produces the problems of legibility you mentioned. On balance, it seems better to use direct listings.

DRAGON SECRET

■ After having used a ZX-81 computer for over 12 months, I would now like to buy myself a micro. I read with some interest about the Dragon 32 in *Your Computer* but having sent for the brochure, I feel some vital information has been left out:

■ What is the speed of its Basic interpreter compared with the Vic-20, and is the 6809E processor superior to the 6502 as Dragon claims it to be?

■ How many colours may appear on the screen at any one time?

■ Does it have a white-noise generator and normal tone generators, and can they work independently of the screen so that on-screen action is not halted while the sound effects are in operation?

Peter Arnfield,
Stockport, Cheshire

I DO NOT have the results of any benchmarks on the Dragon. The 6809E is a more modern chip than the 6502 which suggests it bears the fruit of later development. The number of colours you can use at any time falls as the resolution increases. You can use only two colours at once in the highest mode, but they are point by point colours, not grid colours as on the Spectrum. There is only a single channel for sound, and it is music, not white noise. If you want to get a good idea of what a Dragon looks like in action, go to a Tandy store and play with the Color Computer. It seems to me to have been built around the same extended colour Basic ROM written by the American company Microsoft, and in many respects could almost be described as the same machine — as in fact the Binatone computer promises to be. ■

A bigger range than the Himalayas



The Acorn Atom From £118 plus VAT.

Personal Computing – Instructional and Fun

To get the best out of personal computing you need two things – hardware that is powerful and reliable – software that uses the hardware to the full. The Atom range is just that.

The Atom – tried and tested

The Atom was designed to last – inside and out. Outside a rugged, high impact case with a proper keyboard. Tested to withstand children as well as adults. Inside a powerful operating system that will never be bettered. It is available in several versions so you can choose what you want. And there is an enormous range of additional boards that fit inside the casing – start where you like – add more power, more versatility when you need it.

The Accessories – something for everyone

Diskpacks, printers, monitors, plug-in ROM's, manuals, other languages, arcade-type games, business and household software. Whatever you want to do – teach your children, run your business – you can't do better than choose the Atom range.

Available Nationwide

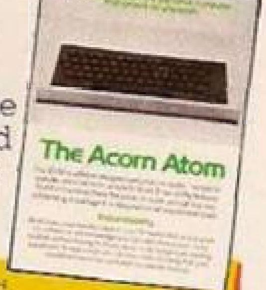
Not just mail order, the Atom range can be bought through a national dealer network – they will help and advise you. And in the unlikely event of breakdown they will be there. Like our equipment Acorn Computers are here to last.

ACORN COMPUTER

Acorn Computers Limited, Fulbourn Road, Cherry Hinton, Cambridge CB1 4JN Tel: (0223) 245200

FREE Catalogue

For full details of the complete range and a list of dealers just fill in the coupon or write to us.



To: Acorn Computers Ltd. Fulbourn Road, Cherry Hinton Cambridge CB1 4JN Tel: (0223) 245200

Please rush me a complete list of the Atom range.

Name ______________________

Address ______________________

____

____

____

Postcode ______________________

FINGERTIPS

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

A SOLUTION TO the Birthdays problem set in the September Fingertips column was sent in by Alan Stevens of Derby. This program for the Texas TI-59 gives the probability, Pr, that in a group of r people at least two of them have birthdays on the same day of the year by:

$$Pr = 1 - \frac{N!}{(N-r)!N^r}$$

where N = 365, ignoring leap years. This can be rewritten as:

$$\prod_{k=0}^{r-1} (1-k/N) = 1-Pr$$

where Pi indicates "product of".

For a particular Pr the program below calculates the above product for successively increasing values of r, which is in STOre 00, until the product equals 1−Pr, or rather until the product is just less than 1−Pr.

Address	Key
000	(
001	1
002	−
003	RCL 00
005	÷
006	365
009	)
010	×
011	2nd Op 20
013	2nd x⩾t 000
016	RCL 00
018	R/S

Before running ensure that STOre 00 is zeroed, and enter the value of 1−Pr in the t register.

	Enter	Press	Display
1		2nd CMs	0
2	1−Pr	x⇌t	0
3		RST	0
4		R/S	r

For Pr = 0.6 we find r = 27 people.

One may quibble that the x⩾t at address 013 should strictly be x>t, but this is not available on the TI-59. This may be overcome by using negative rather than positive numbers and INV 2nd x⩾t (≡ x<t), which requires three extra steps in the program. However, the likelihood of getting exact equality is so remote that there seems little point in doing it.

As well as this Birthdays solution, Alan Stevens has sent us Undercut, a calculator game based on a number game invented by Douglas R Hofstadter. It is for two players: here, the calculator is one player. Each guesses a number from one to five. If the two numbers differ by one, the player with the smaller number increases his score by the sum of the two numbers, the other player's score being unaltered. If the two numbers do not differ by exactly one each player increases his score by the number he or it guessed.

Thus, guessing a five will increase your score significantly — unless your opponent guesses a four. Guess a one and you cannot be undercut — but your opponent might guess more than two and hence score more heavily than you. Can you outguess the calculator over a series of trials? Needless to say, the calculator doesn't cheat.

Initialise the program by entering any number to be used as a seed for the random number generator, and press E. Then enter your guess — an integer in the range one to five and press A. Repeat the last operation for as long as you want to play the game. After each of your guesses the calculator guesses a number which it displays for about half a second. It then calculates and updates both its own and your score and displays the cumulative difference. If the result is positive you are ahead, if negative the calculator is ahead that is, it displays "player cumulative score — calculator cumulative score".

The program turns negative guesses into positive ones, and takes the integer part of a non-integer guess. Other guesses outside the range one to five are rewarded by a flashing one — press CLR to continue.

The number of trials is not used by the program, but is recorded and may be found by pressing RCL 00.

The program uses the random number generator of the TI-59's master module. This puts the calculator in a fixed format state, so if the program is to be recorded on magnetic card, INV 2nd Fix should be pressed first.

Alan Stevens' Undercut.

ADDRESS	KEY		
000	2ND X=T 012	070	RCL 2ND IND 06
003	RCL 11	072	)
005	SUM 13	073	2ND X⩾T 064
007	RCL 12	076	RCL 06
009	SUM 14	078	STO 11
011	INV SBR	080	2ND PAUSE
012	RCL 10	081	−
014	2ND X⩾T 024	082	RCL 12
017	13	084	=
019	STO 06	085	STO 10
021	GTO 028	087	2ND |X|
024	14	088	−
026	STO 06	089	1
028	(	90	=
029	RCL 11	091	SBR 000
031	+	094	(
032	RCL 12	095	RCL 14
034	)	097	−
035	SUM 2ND IND 06	098	RCL 13
037	INV SBR	100	)
038	2ND LBL A	101	R/S
040	2ND |X|	102	1 +/−
041	2ND INT	104	√x
042	STO 12	105	R/S
044	2ND X=T 102	106	2ND LBL E
047	−	108	STO 09
048	6	110	.152
049	=	114	STO 01
050	2ND X⩾T 102	116	.545
053	2ND OP 20	120	STO 02
055	2ND PGM 15	122	.742
057	SBR 2ND D.MS	126	STO 03
059	STO 11	128	.985
061	CLR	132	STO 04
062	STO 06	134	1
064	2ND OP 26	135	STO 05
066	(	137	CLR
067	RCL 11	138	STO 00
069	−	140	STO 13
		142	STO 14
		144	R/S

Memory contents:

STOre	Contents
00	number of trials
01	.152
02	.545
03	.742
04	.985
05	1
06	indicator
07	used by random number generator
08	" " " "
09	seed
10	player no. − calculator no.
11	calculator
12	player's number
13	calculator's cumulative score
14	player's cumulative score

Concerning Roy Sirl's TI-57 Probability Program, September, 1982, A M Simpson of Perth sent us the following table of timings achieved on his TI-58, using the two examples in the article:

	LOCS	EX 1	EX 2
A	92	140	145
B	63	43	50
C	75	15	8
D	80	12	6

Time in seconds

A is Sirl's program adapted for TI-58; B is Sirl's algorithm via library program 16; C is Simpson's program, user-defined labels version and D is as C but using absolute addresses.

An example of the latter is printed here, with some background notes, including proof of equivalence to Roy Sirl's algorithm.

As you can see from C above, A M Simpson's program should be easily adapted to run on a TI-57; it is for this reason that the four parameters required by it still need to be entered outside the program.

TI-58/59 users, on the other hand, might find it easier to use user-defined labels to control entry of the parameters, and they should have no difficulty in developing A M Simpson's program into an automatic probability table generator.

Here are the background notes on A M Simpson's program. The algorithm used was:

$$P_{(r)} = \frac{(n-r)^{(a-u)} \cdot a^{(u)} \cdot r^{(u)}}{u! \cdot n^{(a)}}$$

where:

$$x^{(y)} = x(x-1)\ldots \text{ to } y \text{ terms}$$

The proof of equivalence to Roy Sirl's algorithm is set out as follows, expressing 1 in factorials:

$$P_{(r)} = \frac{a!\, b!\, r!\, (n-r)!}{u!\, v!\, n!\, (a-u)!\, (b-v)!}$$

where:

$$b = n-a;\ v = r-u$$

Sirl's algorithm, using capitals to minimise confusion, is:

$$P_{(A,B,M,N)} = \frac{C^{A}_{M} \times C^{B}_{N-M}}{C^{A+B}_{N}}$$

where:

$$C^{X}_{Y} = \frac{X!}{Y!(X-Y)!}$$

(continued on next page)

Below: A M Simpson's probability listing.

KEY	LOC	CODE
2ND CP	000	29
RCL	001	43
3	002	03
−	003	75
RCL	004	43
4	005	04
=	006	95
2ND X=T	007	67
0	008	00
42	009	42
STO	010	42
05	011	05
1	012	01
X ↔ T	013	32
RCL	014	43
1	015	01
−	016	75
RCL	017	43
2	018	02
=	019	95
SBR	020	71
0	021	00
64	022	64
RCL	023	43
4	024	04
STO	025	42
5	026	05
SBR	027	71
0	028	00
64	029	64
RCL	030	43
4	031	04
STO	032	42
5	033	05
RCL	034	43
3	035	03
SBR	036	71
0	037	00
64	038	64

(listing continued on next page).

(continued from previous page)

Expressing the above in factorials:

$$P_{(A,B,M,N)} = \frac{A!\,B!\,N!\,(S-N)!}{M!\,L!\,S!\,(A-M)!\,(B-L)!}$$

where:

$S = A + B$; $L = N - M$

Therefore, the second and fourth equations are equal, as corresponding factors are identical:

Fourth	Second	
S	n	The universal set; (=a+b)
N	r	The sample size; (=u+v)
A	a	No in n of required class;
B	b	n–a;
M	u	No in r to be of required class;
L	v	r–u

M J Robertson's program is for a Casio FX-602P and MP-10. It is designed to produce a sketch of a mathematical function.

To execute the program, the function required must first be keyed into P1 using Mode2. Then revert back to Mode1 and press P0. The program halts and asks for "x max". This is entered using EXE. The program then asks for "x min" and a similar procedure is adopted.

The program then asks for the Y Scale, the number of lines of output from the printer that you wish the graph sketch to take up. Enter the appropriate value and press EXE. The calculator then responds with "points".

There are two options with this prompt, EXE or O EXE. Entering O EXE will produce a list of co-ordinates of the points to be plotted (the first pair of digits are for the far left column of the printer, and the last pair for the far right of the printer output). Pressing EXE only leads to the calculation of the co-ordinates: they are not printed. When all the points have been calculated the calculator responds with Ymax. This facility allows the breaking up of a curve into several parts.

If the maximum value of the part of the curve you want is known, by differentiation, entered, and EXE pressed then that value will be used. Hence if you divide a curve up into equal parts in relation to the x axis, then you can enter these one by one and the Y scale will be the same for all of them. This enables a long, or more accurate, curve to be produced since the resulting output can be linked side by side, each with the same scale.

However, if you just wish for a single curve to be produced, just pressing EXE after the Ymax prompt will result in the calculator automaticaly taking the maximum value it has just calculated and using that to determine the scale. Having entered the appropriate response to Ymax, the calculator will then set about plotting the graph as desired.

Mode .40 must be used. This allows only nine steps for P1, however if a larger function is required some of the alpha comments can be temporarily deleted.

The following programs by T Briggs were designed for the ambitious occasional punter aiming for big returns. Program P0 provides a quick and accurate calculation of Yankee bets in which all combinations of two or more horses are covered. The stake is entered first, followed by the number of horses to be covered. The display then shows the number of bets involved.

When the results are known, the odds of each winner are entered. Non-runners are entered as 0, losers as –1. After the final entry is made, the profit or loss is displayed followed by the amount to be collected from the bookie, including stakes.

Program P1 is designed for calculation of straightforward multiple bets, doubles, trebles and unlimited accumulators. As in the previous program, the stake and number of horses are entered. Results are keyed in, after which nett and gross returns are displayed, followed by the cumulative total of winnings if more than one bet is made. ■

(listing continued from previous page)

GTO	039	61
0	040	00
44	041	44
1	042	01
X↔T	043	32
RCL	044	43
3	045	03
STO	046	42
5	047	05
RCL	048	43
1	049	01
SBR	050	71
0	051	00
64	052	64
RCL	053	43
4	054	04
STO	055	42
5	056	05
RCL	057	43
2	058	02
SBR	059	71
0	060	00
64	061	64
X↔T	062	32
R/S	063	91
STO	064	42
0	065	00
X↔T	066	32
1/X	067	35
X	068	65
RCL	069	43
0	070	00
2ND OP	071	69
30	072	30
2ND DSZ	073	97
5	074	05
0	075	00
68	076	68
=	077	95
X↔T	078	32
INV SBR	079	92

TO RUN — r STO 02, a STO 03, u STO 04, Press RST, n STO 01, R/S

M J Robertson's mathematical function stretcher.

```
PROGRAM LIST
MR0-39,F-1F 352steps
FILE :  GRAPH

*** P0
9 EXP 99 Min10
9 +/- EXP 99 Min11
"X max"
HLT MinF
"1: #"
GSBP9
"X min"
HLT Min1F Min20
"2: #"
GSBP9
" "
19 Min15
GSBP2
21 Min00
"Y Scale ?"
HLT - 1 = Min15
"Points ?"
HLT Min18
LBL0
MR1F + MR01 = IND
Min00 Min1F
1 M+00
MR00 - 40 = x=0
GOTO1
GOTO0
LBL1
20 Min00
LBL2
IND MR00 Min01
GSBP1
Min13
MR18 x=0
GSBP9
MR13 IND Min00
MR11 MinF
IND MR00 x≥F Min11
MR10 MinF
IND MR00 x≥F GOTO4
Min10
LBL4
1 M+00
MR00 - 40 = x=0
GOTO3
GOTO2
LBL3
" "
GSBP9
MR11
"Y max ?"
HLT Min11 FIX4 =
"Y max: #"
GSBP9
MR10 FIX4 =
"Y min: #"
GSBP9
" "
GSBP9
MR11 MinF
MR10 Min1F
20 Min00
GSBP2
9 EXP 99 MinF
LBL5
IND MR00 - MR01 =
FIX0 IND Min00 x≥F
GOTO8
IND MR00 MinF
LBL8
1 M+00
MR00 - 40 = x=0
GOTO6
GOTO5
LBL6
MRF x≥0 GOTO9
GSBP6
LBL9
GSBP5
MR15 x=0 GOTO7
1 M-15 GOTO9
LBL7
          ···245steps

*** P1
sin
          ···002steps

*** P2
MRF - MR1F = ÷ MR15
= Min01
          ···009steps

*** P5
20 Min00
MR15 MinF
LBL4
IND MR00 x=F GOTO1
":"
LBL2
1 M+00
MR00 - 40 = x=0
GOTO3
GOTO4
LBL1
"*"
GOTO2
LBL3
"1"
GSBP9
          ···037steps

*** P6
20 Min00
LBL0
MRF IND M-00
1 M+00
MR00 - 40 = x=0
GOTO1
GOTO0
LBL1
          ···019steps

*** P8
" "
GSBP9
MR01 FIX4 =
"X = #"
GSBP9
MR13 FIX4 =
"Y = #"
GSBP9
          ···029steps

*** P9
SAVE invEXE
          ···003steps
```

```
P0: 337 STEPS
   5 PRT CSR 4;"-**Y
      ANKEES**-":VAC
  10 INP "STAKE",A,"
      NO.OF HORSES",X
      :Y=X
  20 IF X=6;X=58
  21 IF X=5;X=27
  22 IF X=4;X=12
  23 IF X=3;X=5
  30 Z=X-1:PRT Z;" B
      ETS",
  35 FOR N=1 TO Y
  40 INP "ODDS,L(-1)
      ,NR(0)",A(N):A(
      N)=A(N)+1
  45 NEXT N
  50 O=(A1*A2+A1+A2+
      1)*(A3*A4+A3+A4
      +1)*(A5*A6+A5+A
      6+1)
  60 X=X+A1+A2+A3+A4
      +A5+A6:P=A*(O-X
      )
  65 SET F2
  70 IF P>0 THEN 85
  80 PRT "LOSE";P*-1
      :GOTO 90
  85 PRT "WIN";P
  90 PRT "COLLECT";P
      +(Z*A):VAC :GOT
      O 10
P1: 151 STEPS
  10 PRT "MULTIPLE B
      ETS":VAC
  20 INP "STAKE",A,"
      NO.OF HORSES",I
      :C=A
  30 FOR N=1 TO I
  40 INP "ODDS",B
  50 C=C*B+C
  60 NEXT N
  65 SET F2
  70 D=D+C-A:PRT "CO
      LLECT";C,"WIN";
      C-A
  80 PRT "TOTAL WON"
      ;D:GOTO 20
```

Horse-racing programs by T Briggs.

Example of $Y = -x^2$ with co-ordinates displayed.

```
X max: 19   X = 1
X min: -19  Y = -1

X = -19     X = 3
Y = -361    Y = -9

X = -17     X = 5
Y = -289    Y = -25

X = -15     X = 7
Y = -225    Y = -49

X = -13     X = 9
Y = -169    Y = -81

X = -11     X = 11
Y = -121    Y = -121

X = -9      X = 13
Y = -81     Y = -169

X = -7      X = 15
Y = -49     Y = -225

X = -5      X = 17
Y = -25     Y = -289

X = -3      X = 19
Y = -9      Y = -361

X = -1      Ymax:-1
Y = -1      Ymin:
            -361
```

Software File gives you the opportunity to have your programs, ideas or discoveries published. We will accept contributions for any personal computer and will group programs for like machines together in the file. Please double-check your listings before sending them, and specify the memory they require. Mark your letter clearly for *Your Computer.* We will pay £6 for each contribution published.

Submarine

M Fox,
Aldridge,
West Midlands.

ZX-81

THIS IS A complex game of naval strategy in about 12K of RAM, based on a visual map of the area of battle and is an excellent example of the use of multi-dimensional arrays for the storage of certain types of data.

You are the captain of a submarine attacking a horde of enemy ships at anchor in a lagoon. You have to destroy them without running out of power, being destroyed by depth-charges, eaten by sea monsters, hitting a mine or running aground. The game is relatively self-explanatory when being played but the actual commands do need some explanation.

First, you may move in any one of eight directions using the command 1:

```
8  1  2
7     3
6  5  4
```

100 power moves you one square. You must be careful not to ram anything when moving. After you move, the sea-monsters also move — this is done in fast mode to save time. During this process **BADOOM** represents the demise of a sea-monster on a mine.

Second, you have two options for the command 2, Sonar. Option 1 draws a map of the battle area, in which:

- ● Edge of the battle area
- * Mine
- X Your submarine
- S Enemy ship
- H Your H Q
- $ Sea monster
- \+ Island

The second Sonar option enables you to track the path that a torpedo or missile would take. It prints a list of the things that it would hit.

Torpedoes, command 3, is used to launch a torpedo which has a range of three. They cannot destroy islands. Missiles, launched by command 4, have a variable range and use fuel. 100 fuel is equal to one square range. Missiles can destroy islands but ignore sea monsters.

Command 5, Repairs, is a command enabling you to repair damage — though it does use some power. There is a Status/Damage Report command. The Headquarters command, number 7, enables you to get extra supplies and power. It can only be used with over 16 enemy ships and you must be within two squares of your HQ.

Command 8, Sabotage, is a useful way of getting rid of enemy ships, and has a range of two. Conversion is used to convert fuel to power or power to fuel, at a one to one exchange rate. This is command 9. The symbol 0 gives a list of the commands. If you enter a wrong command Break the program and Goto 240. It is advisable to start games with a map.

The map is held in the array A(15,20) and is set up in lines 10 to 140. If the number 0 is held in the array then the corresponding square on the map is empty, 1 represents a mine, 2 your submarine, 3 an enemy ship, 4 your HQ, 5 a sea monster and 6 an island. This enables the printing of the map to be a very easy process — a string is set up containing the symbols used for each character on the map, line 2055

LET A$="*XSHS$+"

Then that string is sliced and the character from the section of the string of the value of that square of the array, +1, is printed — lines 2052 to 2150.

All the inputs wherever possible are done by Inkeys to make the game easier and more pleasant to play. The crew, power, fuel, torpedoes and missiles are located at lines 160 to 200. Lines 230 to 260 input your choice of command and 270 to 290 print the possible options. Damage is kept in the variable D(9) corresponding to the command option. Damage is caused by the enemy depth-charging you after the commands Movement, Torpedoes, Missiles, Sabotage and Conversion. This is done at 6200 onwards to 6640 where a varying degree of damage is selected and inflicted from No Damage, 6260, to Critical Damage, 6490, where you have to send Help in a code which is printed on the screen for one second then removed — if you get it wrong no help comes and you die. The time can be changed at line 6550. You may find that you need 100 — two seconds — to start with, but later this will become too easy. After every command where damage is received, 1,3,4,8 and 9, the damage is automatically repaired by 1 at 5200.

Lines 1000 to 1080 collect the information for movement — direction and distance; 1090-1190 move the submarine checking if it hits anything and making sure that it does not go off the edge. Some clever manoeuvres can be devised making use of this facility. If you hit something when moving line 1160 sends

(continued on next page)

```
   5 DIM A(15,20)
   6 RAND
   7 LET R$=" DAMAGED"
   8 LET G$="HOW MUCH TO USE ?"
   9 LET ZC=2
  10 LET S=INT (RND*8)+12
  13 LET S1=10
  15 LET S2=10
  17 LET A(S1,S2)=2
  22 LET S4=INT (RND*20)+1
  24 LET S3=INT (RND*15)+1
  26 LET A(S3,S4)=4
  30 PRINT AT 10,5;"SETTING UP B
OARD"
  35 FOR N=1 TO 6
  40 IF N=2 OR N=4 THEN NEXT N
  50 IF N=1 THEN FOR M=1 TO INT
(RND*5)+10
  60 IF N=3 THEN FOR M=1 TO 5
  70 IF N=5 THEN FOR M=1 TO INT
(RND*8)+8
  80 IF N=6 THEN FOR M=1 TO 5
  90 LET X=INT (RND*15)+1
 100 LET Y=INT (RND*20)+1
 110 IF A(X,Y)<>0 THEN GOTO 90
 115 IF N=1 OR N=6 THEN IF X=1 O
R X=15 OR Y=1 OR Y=20 THEN GOTO
90
 120 LET A(X,Y)=N
 130 NEXT M
 140 NEXT N
 145 CLS
 150 DIM D(9)
 160 LET C=30
 170 LET P=6300
 180 LET F=2500
 190 LET T=10
 200 LET M=3
 210 LET D=0
 220 IF S>16 THEN LET D=1
 230 PRINT "THERE ARE ";S;" SHIP
S TO DESTROY"
 240 PRINT
 245 PRINT "WHAT ARE YOUR ORDERS
?"
 247 IF INKEY$="" THEN GOTO 247
 249 LET A$=INKEY$
 250 IF A$<"0" OR A$>"9" THEN GO
TO 247
 253 LET A=CODE A$-28
 255 CLS
 260 IF A<>0 THEN GOTO A*1000
 270 PRINT "(1) MOVING",,"(2) SO
NAR",,"(3) FIRE TORPEDOES","(4)
MISSILE CONTROL","(5) REPAIRS",,
"(6) STATUS REPORT"
 280 PRINT "(7) H.Q.",,"(8) SABO
TAGE",,"(9) POWER CONVERSION"
 290 GOTO 240
1000 IF D(1)<0 THEN PRINT "ENGIN
E";R$
1020 IF D(1)<0 THEN GOTO 240
1030 PRINT "COURSE? 812",,TAB 8;
"7*3",,TAB 8;"654"
1033 LET A$=INKEY$
1035 IF A$<"1" OR A$>"8" THEN GO
TO 1033
1040 LET Z=CODE A$-28
1045 PRINT AT 1,9;A$;"3",,,
1050 PRINT "POWER=";P,,,G$
1060 INPUT P1
1065 LET ZC=1
1070 IF P1>P OR P1<100 THEN GOTO
 1050
1080 LET P1=INT (P1/100)
1090 LET X=S1
1100 LET Y=S2
1110 FOR N=1 TO P1
1120 IF X<>15 THEN IF Z=6 OR Z=5
 OR Z=4 THEN LET X=X+1
1130 IF Y<>20 THEN IF Z=2 OR Z=3
 OR Z=4 THEN LET Y=Y+1
1140 IF Y<>1 THEN IF Z=6 OR Z=7
OR Z=8 THEN LET Y=Y-1
1150 IF X<>1 THEN IF Z=8 OR Z=1
OR Z=2 THEN LET X=X-1
1160 IF A(X,Y)<>0 THEN GOTO 1200
1170 NEXT N
1175 LET P=P-P1*100
1183 LET A(S1,S2)=0
1185 LET S1=X
1187 LET S2=Y
1190 LET A(S1.S2)=2
1192 PRINT "MOVEMENT OVER POWER=
";P
1194 GOTO 6200
1200 IF A(X,Y)=1 THEN PRINT "BAD
OOM A MINE"
1210 IF A(X,Y)=3 THEN PRINT "YOU
 RAMMED A SHIP"
1220 IF A(X,Y)=4 THEN PRINT "YOU
 RAMMED H.Q."
1230 IF A(X,Y)=5 THEN PRINT "GUL
P SLURP"
1240 IF A(X,Y)=6 THEN PRINT "YOU
 RAN AGROUND"
1250 IF A(X,Y)=3 THEN LET S=S-1
1255 IF S=0 THEN GOTO 9500
1260 PRINT ,,"YOU LOSE",,"THERE
WERE ";S;" SHIPS LEFT"
1270 STOP
1280 PRINT "REACTOR DEAD SUB SIN
KS"
1290 GOTO 1260
2000 IF D(2)<0 THEN PRINT "SONAR
";R$
2020 IF D(2)<0 THEN GOTO 240
2030 PRINT " OPTION?",,,,"(1) MA
P",,"(2) TRACKING"
2040 IF INKEY$="2" THEN GOTO 216
0
2045 IF INKEY$="1" THEN GOTO 205
1
2050 GOTO 2040
2051 CLS
2052 FOR N=0 TO 21
2053 PRINT AT 0,N;".";AT 16,N;".
"
2054 NEXT N
2055 LET A$=" *XSH$+"
2060 FOR X=1 TO 15
2065 PRINT AT X,0;".";
2070 FOR Y=1 TO 20
2110 PRINT A$(A(X,Y)+1);
2120 NEXT Y
2130 PRINT "."
2140 NEXT X
2145 LET P=P-50
2150 GOTO 240
2160 PRINT ,,"RANGE=?"
2165 IF INKEY$<>"" THEN GOTO 216
5
2170 LET A$=INKEY$
2173 IF A$<"1" OR A$>"9" THEN GO
TO 2170
2175 LET A=CODE A$-28
2177 PRINT AT 5,6;A$
2180 LET P=P-A*20
2190 FOR X=S1-A TO S1+A
2200 FOR Y=S2-A TO S2+A
2210 IF X<1 OR Y<1 OR X>15 OR Y>
20 THEN GOTO 2250
2215 IF A(X,Y)=0 THEN GOTO 2250
2220 IF A(X,Y)=1 THEN PRINT "MIN
E"
2225 IF A(X,Y)=2 THEN PRINT "YOU
"
2230 IF A(X,Y)=3 THEN PRINT "ENE
MY SHIP"
2235 IF A(X,Y)=4 THEN PRINT "H.Q
."
```

(listing continued on next page)

(continued from previous page)

you to 1200 which prints the message.

After Movement, the sea monsters move. These home in on you by one square each time. This is done in Fast mode at 5210. It scans the board square by square, 5240-5260, and when it finds a sea monster it homes him in by one square, 5270-5320, and if he has landed safely it saves his co-ordinates in B — number of sea monsters found so far,1 — and B(A,2) then removes the old image, 5450-5470. If a sea monster lands on a mine both it and the mine are removed from the map, 5530-5550. If it lands on you then it eats your whole submarine and you lose. If it lands on anything else it is replaced in its old position and does not destroy it. Sea monsters can be blocked this way and it is a good strategic move. At the end of this process lines 5570-5600 restore the re-positioned sea monsters to the map.

Lines 2160 to 2270 produce the torpedo or missile tracking by searching an area of three squares all around you in horizontal stripes going down.

The torpedo routine at 3000 is used for both torpedoes and missiles, 3030 to 3070 checking the area, in the same way as 2160-2270, and 3100-3160 printing the appropriate message. The short section at 4000 merely sets up missiles before jumping to 3030.

At 5000-5050 is the damage-repair routine. A status report is printed at 6000; 7000 is the HQ facility resetting your power and fuel. The sabotage routine is 8000. It checks an area two squares around you and destroys a random selection of the ships in that area around you. At 9000 is the conversion routine for converting fuel to power and power to fuel on a one-to-one basis.

Due to its immense size and the heartbreak if it is lost after typing it all it, it is best to save this program twice. This takes about four minutes each when finished. Remember to Clear the variables when saving, as these can add another minute to the time. This is done by 9900-9930. Do not forget to put in line 6475, which is at the end of the listing. To make the game harder or easier you can alter the original power, line 170; fuel, line 180; torpedoes, line 190; missiles, line 200; crew, line 160; ships, line 10; mines, line 50; sea monsters, line 70; and islands, line 80.

The variables are: A(15,20) is the map; ZC is the flag for whether to move sea monsters or not — 1 means yes, 2 means no; S represents number of ships left; S1+S2 are the co-ordinates of your submarine; S3+S4 are the co-ordinates of your HQ; D(9) is damage; P is power; F is fuel; C is crew; T is torpedoes; M is missiles; D is whether or not an HQ is allowed to be used — 1 means yes, 0 means no; P1,A,N,X,Y,M,R$,G$,A$,V,W,Z+SC are general usage variables.

```
2240 IF A(X,Y)=5 THEN PRINT "SEA
 MONSTER"
2245 IF A(X,Y)=6 THEN PRINT "ISL
AND"
2250 NEXT Y
2260 NEXT X
2270 GOTO 240
3010 IF D(3)<0 THEN PRINT "TUBES
";R$
3015 IF T=0 THEN PRINT "NO TORPE
DOES"
3020 IF T=0 OR D(3)<0 THEN GOTO
240
3025 LET Z=3
3030 FOR X=S1-Z TO S1+Z
3040 FOR Y=S2-Z TO S2+Z
3045 IF Y<1 OR X<1 OR Y>20 THEN
GOTO 3060
3050 IF A(X,Y)<>0 THEN GOTO 3100
3060 NEXT Y
3070 NEXT X
3080 LET P=P-150
3085 LET T=T-1
3090 GOTO 6200
3100 IF A(X,Y)=1 THEN PRINT "YOU
 HIT A MINE"
3105 IF A=4 AND A(X,Y)=5 THEN GO
TO 3060
3110 IF A(X,Y)=2 THEN PRINT "**Y
OU HIT YOURSELF**"
3115 IF A(X,Y)=6 AND A=4 THEN GO
TO 4250
3120 IF A(X,Y)=3 THEN PRINT "ENE
MY SHIP SUNK"
3125 IF A(X,Y)=4 THEN GOTO 3165
3130 IF A(X,Y)=5 THEN PRINT "A S
EA MONSTER HAD A TORPEDO FOR LUN
CH"
3135 IF A(X;Y)=6 THEN PRINT "TOR
PEDO WASTED ON AN ISLAND"
3140 IF A(X,Y)=2 THEN GOTO 1260
3145 IF A(X,Y)=3 THEN LET S=S-1
3155 IF A(X,Y)<>6 THEN LET A(X,Y
)=0
3160 IF A=3 THEN GOTO 3080
3163 GOTO 6200
3165 LET A(X,Y)=0
3170 LET D=0
3175 LET S3=0
3180 LET S4=0
3190 IF A=3 THEN GOTO 3080
3195 GOTO 6200
4000 IF M=0 THEN PRINT "SILOS EM
PTY"
4010 IF D(4)<0 THEN PRINT "SILOS
";R$
4020 IF C<23 THEN PRINT "NOT ENO
UGH CREW"
4030 IF M=0 OR C<23 OR D(4)<0 TH
EN GOTO 240
4040 PRINT "FUEL=";F,,G$
4050 INPUT Z
4060 LET F=F-Z
4070 LET Z=INT (Z/100)
4080 LET M=M-1
4090 GOTO 3030
4250 LET A(X,Y)=0
4260 PRINT "YOU BLASTED AN ISLAN
D"
4270 GOTO 6200
5000 IF D(5)<-5 THEN PRINT "REPA
IR IMPOSSIBLE"
5005 IF D(5)<-5 THEN GOTO 240
5009 PRINT "HOW MUCH TO REPAIR?"
5010 INPUT A
5011 LET P=P-(A*15)
5020 FOR N=1 TO 9
5030 LET D(N)=D(N)+A
5040 NEXT N
5045 PRINT "DAMAGE REPAIRED"
5050 GOTO 240
5200 PRINT "-=UPDATE=-"
5201 FOR N=1 TO 9
5202 LET D(N)=D(N)+1
5203 NEXT N
5204 LET P=P-15
5205 IF ZC=2 THEN GOTO 5620
5207 FAST
5210 LET ZC=2
5220 DIM B(16,2)
5230 LET A=0
5235 LET Z=1
5240 FOR X=1 TO 15
5250 FOR Y=1 TO 20
5260 IF A(X,Y)<>5 THEN GOTO 5480
5270 LET V=X
5275 LET A=A+1
5280 LET W=Y
5290 IF W>S2 THEN LET W=W-1
5300 IF W<S2 THEN LET W=W+1
5310 IF V<S1 THEN LET V=V+1
5320 IF V>S1 THEN LET V=V-1
5330 IF A(V,W)=2 THEN GOTO 5500
5340 IF A(V,W)=0 THEN GOTO 5450
5350 IF A(V,W)=1 THEN GOTO 5520
5360 IF A(V,W) THEN GOTO 5480
5450 LET A(X,Y)=0
5460 LET B(A,1)=V
5470 LET B(A,2)=W
5480 NEXT Y
5490 NEXT X
5495 GOTO 5570
5500 PRINT "SLURP GULP"
5505 SLOW
5510 GOTO 1260
5530 LET A(X,Y)=0
5540 LET A(V,W)=0
5550 PRINT "**BADOOM**"
5555 LET Z=Z+1
5560 GOTO 5480
5570 FOR X=1 TO A
5580 IF B(X,1) AND B(X,2) THEN L
ET A(B(X,1),B(X,2))=5
5600 NEXT X
5605 SLOW
5610 GOTO 240
5620 IF D(1)>0 OR D(9)>0 THEN GO
TO 240
5630 PRINT "BOOM-SUB SUNK"
5635 IF P<1 THEN GOTO 1280
5640 GOTO 1260
6000 IF D(6)<0 THEN PRINT "REPOR
TS UNAVAILABLE"
6005 IF D(6)<0 THEN GOTO 240
6010 PRINT ,"POWER......=";P
6015 PRINT ,"FUEL.......=";F
6020 PRINT ,"CREW.......=";C
6025 PRINT ,"ENEMY SHIPS=";S
6030 PRINT ,"TORPEDOES..=";CHR$
(T+28)
6035 PRINT ,"MISSILES...=";CHR$
(M+28)
6040 PRINT ,,,,,,"YOU ARE AT
 (";S1;",";S2;")"
6050 IF D THEN PRINT ,,"H.Q. IS
AT     (";S3;",";S4;")"
6053 IF S=0 THEN STOP
6080 LET A$="ENGINES..SONAR....T
ORPEDOESMISSILES.REPAIR...STATUS
...H.Q......SABOTAGE.CONVERTER"
6090 FOR N=1 TO 9
6100 PRINT AT N-1,0;A$(N*9-8 TO
N*9);"=";INT D(N)
6110 NEXT N
6115 PRINT AT 13,0;
6120 GOTO 240
6200 IF S=0 THEN GOTO 9500
6203 IF P<1 THEN GOTO 1280
6205 PRINT "DEPTH CHARGES TO ";
6210 LET A=RND
6220 IF A>.5 THEN PRINT "STARBOA
RD"
6230 IF A<=.5 THEN PRINT "PORT"
6250 IF RND>.13 THEN GOTO 6280
6260 PRINT "NO DAMAGE"
5270 GOTO 5200
6280 IF RND>.36 THEN GOTO 6330
6290 PRINT "LIGHT DAMAGE"
6300 LET P=P-50
6310 LET D(INT (RND*9)+1)=-(RND*
2)
6320 GOTO 5200
6330 IF RND>.6 THEN GOTO 6410
6340 PRINT "MODERATE DAMAGE"
6350 LET P=P-75+INT (RND*30)
6360 FOR Y=1 TO 2
6370 LET X=INT (RND*9)+1
6380 LET D(X)=D(X)-(RND*8)
6390 NEXT Y
6400 GOTO 5200
6410 IF RND>.75 THEN GOTO 6490
6420 PRINT "HEAVY DAMAGE"
6430 LET P=P-(200+INT (RND*76))
6440 FOR X=1 TO 4+INT (RND*2)
6450 LET Y=INT (RND*9)+1
6460 LET D(Y)=D(Y)-INT (RND*9)+1
6470 NEXT X
6480 GOTO 5200
6490 PRINT "DAMAGE CRITICAL SEND
 ""HELP"" IN CODE "
6500 LET A$=""
6510 FOR X=1 TO 4
6520 LET A$=A$+CHR$ (INT (RND*26
)+38)
6530 NEXT X
6540 PRINT AT 10,10;A$
6550 PAUSE 50
6560 PRINT AT 10,10;"    "
6570 INPUT B$
6580 IF A$<>B$ THEN GOTO 6610
6590 PRINT "THAT WAS CLOSE"
6600 GOTO 6630
6610 PRINT "MESSAGE GARBLED"
6620 GOTO 1260
6630 LET C=C-2
6640 GOTO 5200
7000 IF D(7)<0 THEN PRINT "H.Q."
;R$
7010 IF D=0 THEN PRINT "HARD LUC
K"
7015 LET A=SQR ((S1-S3)*(S1-S3)+
(S2-S4)*(S2-S4))
7016 IF A>2 THEN PRINT "TOO FAR
TO DOCK"
7020 IF A>2 OR D=0 OR D(7)<0 THE
N GOTO 240
7030 PRINT "REFIT"
7040 LET D=0
7050 LET P=4000
7060 LET T=8
7070 LET M=2
7080 LET F=1500
7090 LET C=25
7100 GOTO 240
8000 IF D(8)<0 THEN PRINT "HATCH
ES JAMMED"
8010 IF D(8)<0 THEN GOTO 240
8013 LET Z=0
8014 LET P=P-30
8015 LET SC=0
8020 FOR X=S1-2 TO S1+2
8030 FOR Y=S2-2 TO S2+2
8040 IF X<1 OR X>15 OR Y<1 OR Y>
20 THEN GOTO 8080
8050 IF A(X,Y)<>3 THEN GOTO 8080
8060 LET A=RND
8070 IF A>.3 THEN LET Z=Z+1
8073 IF A>.3 THEN LET A(X,Y)=0
8075 LET SC=SC+1
8080 NEXT Y
8090 NEXT X
8100 IF SC=0 THEN GOTO 8170
8110 PRINT "SHIPS NEAR=";CHR$ (S
C+28)
8111 LET P=P-30
8120 PRINT "SHIPS SUNK=";CHR$ (Z
+28)
8125 LET S=S-Z
8130 LET A=INT (RND*SC)
8140 PRINT "MEN CAUGHT=";CHR$ (A
+28)
8150 LET C=C-A
8160 GOTO 6200
8170 PRINT "NO SHIPS NEAR"
8180 GOTO 240
9000 IF D(9)<0 THEN PRINT "CONVE
RTER";R$
9020 IF D(9)<0 THEN GOTO 240
9030 PRINT "(1) F-P   (2) P-F"
9035 IF INKEY$="2" THEN GOTO 920
0
9040 IF INKEY$="1" THEN GOTO 905
3
9050 GOTO 9035
9053 IF F<1 THEN PRINT "NO FUEL"
9057 IF F<1 THEN GOTO 240
9060 PRINT "FUEL=";F,,G$
9070 INPUT A
9080 IF F-A<0 THEN GOTO 9060
9090 LET F=F-A
9100 LET P=P+A
9105 PRINT "POWER=";P
9110 GOTO 6200
9200 PRINT "POWER=";P,,G$
9210 INPUT A
9220 IF P-A<0 THEN GOTO 9200
9230 LET F=F+A
9240 LET P=P-A
9250 GOTO 6200
9500 CLS
9510 PRINT TAB 7;"*****YOU  WON*
****"
9520 PRINT ,,,,,"WELL DONE"
9530 GOTO 6010
9900 SAVE "S■"
9910 FOR N=1 TO 75
9920 NEXT N
9930 SAVE "S■"
6475 IF P<1 THEN GOTO 1280
```

Alien shootout

*Steven Lilley,
Rearsby,
Leicester.*

DRAGON

THIS KIND of program uses quite a few interesting features available on the Dragon 32 computer, such as music and colour. The object of the game is to use the small laser base at the bottom of the screen to shoot the aliens which appear one at a time on or near the top of the screen.

First, you are asked what speed you require between 1 and 10. It is best to start at about 2. Then, there is a short pause, long enough to get to the operating keys. The keys used are A to go left, S to go right and L to fire.

The variables are D for score, S for your speed, Q for your primary laser-base position, T for aliens position, M1$ for your laser-base and M2$ for the aliens ship. The program only takes 724 bytes, so it can be expanded and modified many times over.

```
10 CLS0
20 INPUT"SPEED(.1 TO 10)";S
30 D=0:CLS
40 PMODE0:SCREEN 1,1
50 Q=464
60 M1$=CHR$(143)+CHR$(136+16)+CHR$(126)+CHR$(132+16)+CHR$(143)
70 X=Q
80 FOR F=0 TO10
90 SOUND 200,1:NEXT F
100 PRINT @Q,M1$
110 T=RND(28+6)
120 PRINT @Q,M1$
130 M2$=CHR$(134+48)+CHR$(48+D)+CHR$(137+38)
140 A$=INKEY$
150 IF A$="L" THEN 240
160 IF A$="A" THEN Q=Q-1
170 IF A$="S" THEN Q=Q+1
180 PRINT @T,M2$
190 PRINT @T,"   "
200 SOUND 20,1
210 T=T+S
220 IF T)=160 THEN 360
230 GOTO 120
240 Z=Q-448
250 SOUND 100,1
260 FOR F=Q TO Z STEP-32
270 PRINT @F,"↑":PRINT @F," "
280 IF F=T THEN 330
290 IF F=T+1 THEN 330
300 IF F=T+2 THEN 330
310 NEXT F
320 GOTO 120
330 D=D+1
340 PLAY"V31L255ABCDEFGABCDEFG3ADD"
350 GOTO 110
360 PLAY"V31L200ABCDEGFACBGFFDAEEDFBGACBGFEADBGFFAEAFG"
370 PCLS
380 PRINT:PRINT"TO BAD!":PRINT:PRINT"your mission failed--the
    aliens have landed"
390 PRINT:PRINT"YOUR TOTAL SCORE -)";D
400 PRINT:PRINT"ANOTHER GO?(Y/N)"
410 INPUT,A$:IF A$="Y" THEN RUN
420 END
```

Random graphics

*Jack Schofield,
London W3.*

ATARI

THE ATARI micros have some 37 graphics characters, but these are not used as often as they might be, because the implementation is odd, not to say bizarre. They can be entered from the keyboard, though they are not marked on the keys, by pressing the CTRL key at the same time. But when these characters are used in graphics modes 1 and 2 as double-width and double-depth characters, different ones appear from the ones you typed in. Unless, that is, you have also remembered to change the character-set base to the graphics characters by using

POKE 756,226

Another way to go is to print

CHR$(Y)

for each character you want. Table 9.6 on page 55 of the Basic Reference Manual tells you which is which.

This also lets you change the colour of the character shown by adding 32, 128 or 160 to the CHR$ number. This simple graphics routine illustrates the technique. Line 10 sets Mode 2 without the text window. Line 15 sets the character base for lower-case and graphics characters.

The loop simply fills the screen with random examples. Lines 55 and 60 display the same graphics character, Y, but in three different colours — yellow, Y, magneta, Y+128, and blue, Y+160, respectively.

The program loops forever so press Break to stop it, and type End to stop the sound.

```
10 GRAPHICS 2+16
15 POKE 756,226
20 FOR X=1 TO 64
30 Y=INT(RND(0)*30)
35 IF X/4=INT(X/4) THEN 50
45 PRINT #6;CHR$(Y+32);:SOUND 0,Y,10,8
50 Y=INT(RND(0)*20):SOUND 1,Y,10,8
55 PRINT #6;CHR$(Y);:SOUND 2,Y,10,6
60 PRINT #6;CHR$(Y+128);CHR$(Y+160);
65 NEXT X
70 GOTO 10
```

Dodgems

*Nagaraj Jayakumar,
Royton,
Oldham.*

VIC-20

THE FOLLOWING PROGRAM is for the Commodore Vic-20 with 3.5K and is an arcade game. You are driving a car and the computer is driving another car chasing you. There are five lanes in which you can manoeuvre. The object of the game is to stay alive as long as possible before the computer car crashes into you.

01 — 09	Rem statements
10 — 13	Sound tune
14 — 25	Instructions
200 — 290	Set up board
340 — 610	Movement of cars
800 — 890	Searching for car
900 — 960	Ending routine
1000 — 1080	Change of lane

```
1 REM****************
2 REM*              *
3 REM*   DODGEMS    *
4 REM*              *
5 REM*     BY       *
6 REM*              *
7 REM*N.M.JAYAKUMAR*
8 REM*              *
9 REM****************
10 PRINT"▮▮▮▮▮▮▮▮NAGARAJ JAYAKUMAR▮":PRINT"▮▮▮▮▮▮▮PRESENTS▮"
11 FORA=1TO2000:NEXT
12 POKE36878,15:FORA=1TO8:READB,C:POKE36876,B:FORD=1TOC:NEXT:POKE36876,0:NEXT
13 DATA175,200,175,200,175,200,151,1200,163,200,163,200,163,200,147,1200
14 PRINT"▮▮▮▮▮▮▮":FORA=1TO29:PRINT"▮";:NEXT:PRINT"DODGEMS";:FORA=1TO30:PRINT"▮"
;:NEXT
15 FORA=1TO2000:NEXT
16 PRINT"▮▮▮▮▮▮▮INSTRUCTIONS"
17 PRINT"▮THIS IS A GAME IN      WHICH YOU DRIVE A"
18 PRINT"MOTOR CAR AND ANOTHER CAR WHICH IS BEING     CONTROLED BY THE        COMP
UTER IS"
19 PRINT"CHASING YOU. THERE AREFOUR LANES.AND TO MOVE INTO AN INNER LANE   YOU
USE THE KEY"
20 PRINT" 'L' AND TO MOVE INTO AN OUTER LANE YOU USE THE KEY 'A'.THE OBJECTOF T
HE GAME IS"
21 GETA$:IFA$=""THEN21
22 PRINT"▮▮▮▮▮▮▮▮▮TO TRY AND STAY ALIVE THE LONGEST BEFORE THECOMPUTER'S CAR CO
MES  AND"
23 PRINT"CRASHES INTO YOU. YOU HAVE A TIMING SCORE   O.K..GET READY!!!!!!!!"
24 PRINT"PRESS ANY KEY TO BEGIN"
25 GETA$:IFA$=""THEN25
200 PRINT"▮":FORG=38400TO38906:POKEG,2:NEXT
210 A=160:FORB=1TO26:READC,D,E:FORF=CTODSTEPE:POKEF,A:NEXTF:NEXTB
220 DATA7702,7723,1,7748,7755,1,7757,7765,1,7794,7807,1,7840,7843,1,7845,7849,1
,7886
230 DATA7891,1,7974,7979,1,8016,8019,1,8021,8025,1,8058,8071,1,8100,8107,1,8109
,8117,1
240 DATA8142,8163,1,7702,8142,22,7770,8078,22,7816,7904,22,7948,8036,22,7862,79
94,22
250 DATA7745,8142,22,7787,8099,22,7829,7917,22,7961,8049,22,7871,8003,22,7908,7
930,22
260 DATA7913,7935,22
270 POKE7909,20:POKE7910,9:POKE7911,13:POKE7912,5
290 TI$="000000":PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮";:CLR
295 B=7725:C=8002:L=4
300 PRINTTI$;"▮▮▮▮▮▮";
320 GETA$:IFA$="L"THENGOSUB1040
330 IFA$="A"THENGOSUB1000
340 IFC=8121ORC=8079ORC=8037ORC=7995THENZ=1
345 IFB=8121ORB=8079ORB=8037ORB=7995THENY=1
350 IFC=7725ORC=7771ORC=7817ORC=7863THENZ=2
355 IFB=7725ORB=7771ORB=7817ORB=7863THENY=2
360 IFC=7744ORC=7786ORC=7828ORC=7870THENZ=3
365 IFB=7744ORB=7786ORB=7828ORB=7870THENY=3
370 IFC=8002ORC=8048ORC=8094ORC=8140THENZ=0
375 IFB=8002ORB=8048ORB=8094ORB=8140THENY=0
590 POKEC,32:POKEB,32
600 IFZ=0THENC=C-1
601 IFZ=1THENC=C-22
602 IFZ=2THENC=C+1
603 IFZ=3THENC=C+22
```

(continued on page 103)

ZX Spectrum
20 Programs £6.95

The ZX Spectrum has brought advanced computing power into your home, The Cambridge Colour Collection, a book of 20 programs, is all you need to make it come alive.

No experience required. Simply enter the programs from the book or load them from tape (£2.95 extra) and run.

Amazing effects. All programs are fully animated using hi-res graphics, colour and sound wherever possible.

Entirely original. None of these programs has ever been published before.

Proven Quality. The author already has 30,000 satisfied purchasers of his book of ZX81 programs.

Hours of entertainment

- **Lunar Landing.** Control the angle of descent and jet thrust to steer the lunar module to a safe landing on the moon's surface.
- **Maze.** Find your way out from the centre of a random maze.
- **Android Nim.** Play the Spectrum at the ancient game of Nim using creatures from outer-space.
- **Biorhythms.** Plot the cycles of your Emotional, Intellectual and Physical activity. Some would say this is not a game at all.

Improve your mind

- **Morse.** A complete morse-code training kit. This program will take a complete beginner to R.A.E. proficiency.
- **Maths.** Adjustable to various levels, this program is an invaluable aid to anyone trying to improve their arithmetic.

Run your life more efficiently

- **Home Accounts.** Keeping track of your finances with this easy-to-use program will enable you to see at a glance where the money goes and plan your spending more effectively.
- **Telephone Address Pad.** Instant access to many pages of information.
- **Calendar.** Displays a 3 month calendar past or future, ideal for planning or tracing past events.

ORDER FORM:

Send Cheque or P.O. with order to:–
Dept. C., Richard Francis Altwasser, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP

Please send me

☐ Copies Cambridge Colour Collection Book only £6.95 each.
☐ Copies Cambridge Colour Collection Book & Cassette £9.90 each

Name: ____________________

Address: ____________________

____

Software For The Vic

M/C-SOFT £7.50
M/C monitor and disassembler.

DATABASE £7.50
Create your own custom files.

BANK MANAGER £5.00
Computerise your bank account.

CHARACTER EDITOR £4.50
Create your own Hi-res pictures

'CUSTOM COMMANDS' £6.00
Tape 1.
SCROLL (X);SET X,Y;DISABLE;
ENABLE;GRAPHIC;TEXT.

Send S.A.E. for details; cheques/P.O.s to:

MR CHIP
1 Neville Place, Penrhynside, Llandudno, Gwynedd, North Wales LL30 3BL

ZX81 16K RAMPACKS

WHY NOT buy now, one of the super new RAM PACKS from GROUND CONTROL? The standard version gives 16K of user ram, while the (S) version is fitted with a keyboard sounder enabling much faster entry of programs and less eyestrain due to audible feedback every time a key is pressed. The well engineered case ensures a snug fit to the ZX81.



AVAILABLE NOW WITH

PRICES. (All inclusive for U.K.)

16K RAM PACK (S)	£24.95	Euro post
STANDARD RAM PACK	£19.95	add £2.00

Availability is usually by return for credit cards, 5 days for cheques. There is a 14 day money back guarantee if not satisfied. Please send SAE or IRCs with all enquiries.

Make cheques/P.O.s. payable to GROUND CONTROL and send to: GROUND CONTROL, Alfreda Avenue, Hullbridge, Essex SS5 6LT.

Tel: 0702-230324. (Mon-Fri 9-5)

*Access/Barclaycard no. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
*Cheque/P.O./Cash.

*Delete if not applicable

Please send me: no. *STANDARD RAM PACK/ 16K RAM PACK (S)

NAME ____________________

ADDRESS ____________________

____________________ Postcode ____________________

(continued from page 101)

```
604 POKEC,90 IFC=BTHEN900
607 IFY=0THENB=B-22
608 IFY=1THENB=B+1
609 IFY=2THENB=B+22
610 IFY=3THENB=B-1
620 POKEB,86 IFB=CTHEN900
800 IFL<2ANDB=7778THENPOKEB,32 B=B-44 POKEB,86
805 IFL<4ANDB=7866THENPOKEB,32 B=B-44 POKEB,86
810 IFL<2ANDB=8086THENPOKEB,32 B=B+44 POKEB,86
815 IFL<4ANDB=7998THENPOKEB,32 B=B+44 POKEB,86
820 IFL<3ANDB=7927THENPOKEB,32 B=B-2 POKEB,86
830 IFL<3ANDB=7938THENPOKEB,32 B=B+2 POKEB,86
840 IFL=4ANDB=7822THENPOKEB,32 B=B+44 POKEB,86
845 IFL>1ANDB=7734THENPOKEB,32 B=B+44 POKEB,86
850 IFL>1ANDB=8130THENPOKEB,32 B=B-44 POKEB,86
855 IFL=4ANDB=8042THENPOKEB,32 B=B-44 POKEB,86
860 IFL>2ANDB=7925THENPOKEB,32 B=B+2 POKEB,86
870 IFL>2ANDB=7940THENPOKEB,32 B=B-2 POKEB,86
890 GOTO300
900 A$=TI$ FORA=1TO506
910 POKE7680+(INT(RND(1)*506)+1),160
915 POKE36874,(INT(RND(1)*255)+1) NEXT
920 POKE36874,0 PRINT"YOUR SCORE IS "A$
930 INPUT"TRY AGAIN",B$
940 IFB$="YES"THENRUN
950 IFB$="NO"THENPRINT"BYE BYE" END
960 PRINT"I DO NOT UNDERSTAND    USE YES/NO" GOTO930
1000 IFC=7866ORC=7778THENPOKEC,32 C=C-44 POKEC,90 L=L-1
1010 IFC=7998ORC=8086THENPOKEC,32 C=C+44 POKEC,90 L=L-1
1020 IFC=7927THENPOKEC,32 C=C-2 POKEC,90 L=L-1
1030 IFC=7938THENPOKEC,32 C=C+2 POKEC,90 L=L-1
1035 RETURN
1040 IFC=7734ORC=7822THENPOKEC,32 C=C+44 POKEC,90 L=L+1
1050 IFC=8042ORC=8130THENPOKEC,32 C=C-44 POKEC,90 L=L+1
1060 IFC=7925THENPOKEC,32 C=C+2 POKEC,90 L=L+1
1070 IFC=7940THENPOKEC,32 C=C-2 POKEC,90 L=L+1
1080 RETURN
READY.
```

Slalom

Jonathan Yeomans,
Solihull,
West Midlands.

SPECTRUM

SPECTRAL SKI-ING involves a slalom skier manoeuvring down a course to the finishing post. The graphics are printed by a Read and Data statement on to the screen and Bin statements allow the user to use the high-resolution graphics.

A full set of instructions is contained in the listing, along with Rem statements to tell the user what the computer is doing. Lines 5-40 set up high-resolution graphics; lines 40-80 print out the board; lines 80-160 get the skier moving and lines 160-210 are the ATTR lines that detect if you have hit anything that you should not have.

Lines 300-320 are for when you hit a flag; lines 400-420 are the routine for when you hit a tree and lines 500-530 are the routine for when all your skiers have bitten the snow.

Lines 800-840 are the instructions; lines 900-940 are the routine for when you have finished the course; lines 9000-9030 are the data for the Bin statements, and lines 9030-9040 are the data for printing out the course.

The graphics used are: lines 40 and 50 graphics D, line 60 graphics B, line 80 graphics A, line 115 graphics E, line 125 graphics A and line 190 graphics C and F.

```
   1 GO TO 600
   4 CLS
   5 CLS
   6 FOR n=1 TO 11: PRINT ,,,,:
NEXT n
   8 BORDER 1: PAPER 7: INK 4: L
ET p=5
   9 RESTORE
  10 FOR n=0 TO 7: READ a: POKE
USR "a"+n,a: NEXT n
  15 FOR n=0 TO 7: READ d: POKE
USR "d"+n,d: NEXT n
  20 FOR n=0 TO 7: READ b: POKE
USR "b"+n,b: NEXT n
  25 FOR n=0 TO 7: READ f: POKE
USR "f"+n,f: NEXT n
  30 FOR n=0 TO 7: READ c: POKE
USR "c"+n,c: NEXT n
  35 FOR n=0 TO 7: READ e: POKE
USR "e"+n,e: NEXT n
  40 INK 4: FOR n=0 TO 21: PRINT
 AT n,0;"▲";AT n,31;"▲": NEXT n:
 PRINT AT 0,0;"▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲
▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲";AT 21,0;"▲▲▲▲▲▲
▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲"
  50 FOR n=0 TO 41: READ a,b,c:
FOR m=a TO b: BEEP .01,m: PRINT
AT c,m;"▲": NEXT m: NEXT n
  60 INK 2: FOR n=0 TO 27: READ
a,b: PRINT AT a,b;"¶": BEEP .01,
n: NEXT n: PRINT AT 4,5; INK 7;"
"
  70 PRINT AT 1,1; INK 0;"S";AT
2,1;"T";AT 3,1;"A";AT 4,1;"R";AT
 5,1;"T";AT 15,30; INK 3;"F";AT
16,30; INK 3;"I";AT 17,30; INK 3
;"N";AT 18,30; INK 3;"I";AT 19,3
0; INK 3;"S";AT 20,30; INK 3;"H"
;AT 5,3; INK 7;" "
  80 LET e$="£"
  90 LET x=3: LET y=3: LET a=0:
LET b=0:
 100 LET a$=INKEY$
 105 IF a$="" THEN GO TO 150
 110 IF a$="5" THEN LET b=-1: IF
 a$="5" THEN LET a=0
 115 IF a$="5" THEN LET e$="£"
 120 IF a$="8" THEN LET b=1: IF
a$="8" THEN LET a=0
 125 IF a$="6" THEN LET e$="£"
 130 IF a$="6" THEN LET b=0: IF
a$="6" THEN LET a=1
 140 IF a$="7" THEN LET b=0: IF
a$="7" THEN LET a=-1
 150 LET x=x+a: LET y=y+b
 160 INK 0: PRINT AT x,y;e$: BEE
P .01,15: PRINT AT x,y;" "
 170 IF ATTR (x+a,y+b)=60 THEN G
O TO 400
 180 IF ATTR (x+a,y+b)=58 THEN G
O TO 300
 185 IF ATTR (x+a,y+b)=59 THEN G
O TO 900
 190 PRINT AT 21,8;"♣ ♣ ♣ ♣ ♣ ♣
♣ ♣ ♣ ♣ ♣": BEEP .01,5: PRINT AT
 21,8;"♣ ♣ ♣ ♣ ♣ ♣ ♣ ♣ ♣ ♣ ♣"
 210 GO TO 100
 300 FOR n=50 TO -50 STEP -5: BE
EP .01,n: NEXT n
 310 INK 3: PRINT AT x+a,y+b; IN
K 2;"¶": PRINT AT 21,8; FLASH 1;
"HA HA YOU HIT A FLAG  ": FOR N=
0 TO -45 STEP -2: BEEP .01,N: NE
XT N: PRINT AT 21,8; FLASH 0;"LO
OSE ANOTHER LIFE      ": FOR N=-5
0 TO 50 STEP 4: BEEP .01,N: NEXT
 N
 315 LET p=p-1: IF p=0 THEN GO T
O 500
 320 GO TO 90
 400 FOR n=0 TO 50 STEP 2: BEEP
.01,n: BEEP .01,60-n: NEXT n
 410 INK 2: PRINT AT x+a,y+b; IN
K 4;"▲": PRINT AT 21,8; FLASH 1;
"BAD LUCK YOU HIT A TREE": FOR N
=0 TO 45 STEP 1.75: BEEP .01,N:
NEXT N: PRINT AT 21,8; FLASH 0;"
LOOSE ANOTHER LIFE      ": FOR N=
-50 TO 50 STEP 4: BEEP .01,N: NE
XT N
 415 LET p=p-1: IF p=0 THEN GO T
O 500
 420 GO TO 90
 500 CLS : FOR n=0 TO 21: PRINT
AT n,0; INK 2;"████████████████
████████████████": BEEP .01,n: NE
XT n
 510 PRINT AT 7,8; INK 3;"██████
███████████";AT 13,8;"██████
███████████": FOR n=7 TO 13: PRINT A
T n,8; INK 3;"█";AT n,24; INK 3;
"█": NEXT n
 520 PRINT AT 9,10; INK 0;"GUESS
 YOU RAN";AT 11,10; INK 0;"OUT O
F LIVES!"
 530 INPUT "DO YOU WANT TO PLAY
AGAIN Y/N";T$: IF T$="y" THEN RU
N : STOP
 540 STOP
 600: PAPER 7: BORDER 1: INK 1
 610 CLS
 620 PRINT AT 1,6;"SPECTRUM SKII
NG BY";AT 3,6;"©JONATHAN YEOMANS
";AT 6,1;"WELCOME TO SKIING.MAKE
 YOUR ";AT 8,1;"WAY DOWN THE COU
RSE USING THE";AT 10,1;"CURSOR K
EYS TO DODGE THE FLAGS";AT 12,1;
"AND FOREST TO REACH THE BOTTOM
";AT 14,1;"AND A COLOURFULL CELE
BRATION!";AT 17,4;"BUT BE WARNED
 YOU ONLY";AT 19,8;"HAVE 5 LIVES
"
 630: FOR M=0 TO 50: BEEP .01,M:
```

(continued on next page)

(continued from previous page)

```
 BEEP .01,60-M: NEXT M
 835 PAUSE 600
 840 CLS : GO TO 5
 900 FOR N=-50 TO 50: BORDER INT
 (RND*7): BEEP .01,N: BEEP .01,N
+5: NEXT N
 910 CLS : PAPER 2: INK 6
 920 FOR N=7 TO 13: PRINT AT N,6
;"■";AT N,24;"■": NEXT N: PRINT
AT 7,8;"[redacted]";AT 13,
6;"[redacted]"
 930 PRINT AT 9,10; PAPER 7; INK
 0;"   WE HAVE";AT 11,10;"  A WI
NNER!"
 940 INPUT "DO YOU WANT TO PLAY
AGAIN Y/N";T$: IF T$="y" THEN RU
N : STOP
 950 STOP
9000 DATA BIN 00001100,BIN 00001
100,BIN 00011001,BIN 00011110,BI
N 00011000,BIN 00001000,BIN 0000
1001,BIN 11111110
9010 DATA BIN 00010000,BIN 00010
000,BIN 00111000,BIN 00111000,BI
N 01111100,BIN 01111100,BIN 1111
1110,BIN 00010000
9020 DATA BIN 00001100,BIN 00111
100,BIN 01111100,BIN 00111100,BI
N 00001100,BIN 00000100,BIN 0000
0100,BIN 00000100
9022 DATA BIN 00111000,BIN 00111
000,BIN 00010000,BIN 11111110,BI
N 10111010,BIN 10111010,BIN 0010
1000,BIN 01101100
9024 DATA BIN 00111000,BIN 10111
010,BIN 10010010,BIN 11111110,BI
N 00111000,BIN 00111000,BIN 0010
1000,BIN 01101100
9026 DATA BIN 00110000,BIN 00110
000,BIN 10011000,BIN 01111000,BI
N 00011000,BIN 00010000,BIN 1001
0000,BIN 01111111
9030 DATA 5,30,1,6,8,2,13,30,2,2
5,30,3,28,30,4,27,30,5,1,3,6,9,1
0,6,22,22,6,29,30,6,1,23,7,30,30
,7,1,7,8,12,23,8,30,30,8,1,6,9,1
7,22,9,1,4,9,30,30,9,1,1,10,30,3
0,10,1,1,11,29,30,11,1,1,12,10,1
1,12,29,30,12,1,1,13,9,14,13,22,
30,13,1,1,14,5,15,14,21,30,14,1,
1,14,1,1,15,5,30,15,1,1,16,6,30,
16,1,1,17,1,1,18,19,24,18,1,6,19
,1,30,20
9040 DATA 3,8,3,5,5,5,5,8,2,11,4
,11,4,17,6,17,3,22,5,22,7,24,7,2
8,9,28,9,25,12,23,10,23,11,19,13
,19,10,15,12,15,8,10,10,10,10,7,
12,7,13,2,13,4,16,4,16,2,17,9,19
,9,19,12
```

Atom squash

Robin Ager,
Wimbledon,
London SW19.

ATOM

HERE IS A simple, but smooth and fast-moving, game of squash for the Acorn Atom. It only uses 1K of graphics memory to allow it to Run in a small amount of memory. To make the program even more compact, full use of the Atom's abbreviated commands should be. Use the Q and R keys to control the bat up and down the screen in order to hit the ball against the wall. Due to the bat being curved the ball will be deflected at steeper angles when it hits the far top or far bottom of the bat.

The score is kept by the line at the top of the display, which increases until the target score of 110 is reached. If your three balls are used before you reach this score, the score you have achieved will be displayed at the end of the game.

10	Set up arrays
20	Assembler keyboard scan
12 to 13	Set up court display
20 to 50	See if keys are being pressed or if ball is at edge of court
60	Move ball
70 to 80	Control vertical bounce of ball
89 to 95	See if ball hits or missed bat and acts accordingly and controls horizontal bounce of ball.
2000 to 2030 & 5000 to 5010	End of game routines

```
>L LIST
   1DIMP(-1),B(3);P.#21
   2[;JSR#FE71;STY#80;RTS;]
   3P.$6
   4S=0;D=9
  10 CLEAR1
  11 X=40;Y=40;G=1;H=3;A=1;R=0;L=1;K=0;S=30
  12 GOSUB 1000
  13 GOSUB 4000
  20 IFX>=118 GOS.d
  25 LINK TOP
  26 IF ?#80=49 GOS.b
  27 IF?#80=33 GOS.c
  30 IF X<=10 GOS.e
  40 IF Y>=53 GOS.f
  50 IF Y<=11 GOS.g
  60 PLOT 15,X,Y;WAIT;X=X+H;Y=Y+G;PLOT13,X,Y
  65 GOTO 20
  70gZ=SGN(G)*-1;G=L*Z;R.
  80fZ=SGN(G)*-1;G=L*Z;R.
  89ePLOT13,(10+R),57;IFR=110G.5000
  90IFY>=(S+1)ANDY<=(S+4)T.LETH=3;Z=SGN(G);L=1;G=L*Z;R=R+1;R.
  91 IFY=S ORY=(S+5)THENLETH=3;Z=SGN(G);L=2;G=L*Z;R=R+1;R.
  92 A=A+1;IF A=4G.2000
  93 PLOT15,X,Y
  94 X=10;Y=A.R.%43;Y=Y+11;H=3
  95 FOR T=1TO1500;NEXTT;GOS.1000;R.
 100dH=-3;R.
 200bPLOT 15,D,S;PLOT15,D,(S+1);S=S+2;MOVED,S;DRAW D,(S+5)
 201R.
 300cPLOT15,D,(S+5);PLOT15,D,(S+4);S=S-2;MOVED,S;DRAWD,(S+5)
 301 R.
1000 MOVE10,55;DRAW119,55;DRAW119,9;DRAW10,9;RETURN
2000 P.$12;P."GAME OVER";P.';P."YOU SCORED "R
2005P.''
2010 INPUT"PLAY AGAIN(Y/N)"$B
2020 IF $B="Y"THENRUN
2030END
4000 MOVE10,59;DRAW119,59;RETURN
5000 P.$12;P."WELL DONE YOU REACHED THE MAX."'"SCORE OF 110"
5010 GOTO 2010
```

Soft key

Robert Rancans,
London SW1.

BBC

THE USER-DEFINABLE keys on the BBC Micro can be used to implement useful functions during every programming session by employing this short program.

To start, use the 11 highest line numbers the operating system will allow — 32757-32767 — and assign the desired command to each key thus:

32757	*KEY0L.|M	
32758	*KEY1VDU14|M	Page mode on
32759	*KEY2VDU15|M	Page mode off
32760	*KEY3CLS|M	Clear screen
32761	*KEY4AUTO	Enter your starting line and increment
32762	*KEY5RENUMBER|M	
32763	*KEY6MODE7|M	
32764	*KEY7REM	
32765	*KEY8*CAT|M	More convenient as it combines CAT with a motor-on facility for rewinding tapes, press Escape to cancel
32766	*KEY9RUN|M	
32767	*KEY10OLD|ML.|M	To get out of tricky situations when Escape is treated as an error

Note that you do not have to use quotes when assigning keys. Save this, preferably on a new tape so you can locate it easily. To check the operation of the program press Break twice quickly, rewind the tape and Chain "Soft-keys" or whatever you have called it. Now type New and start entering your main program, making use of the soft keys. Do not press the Break key before typing New as, for some odd reason, the first line number of the soft-key program will then appear on the screen as line 245.

The commands will remain active after pressing Break once. To enter a new program without clearing the soft keys, type New — obviously you must not use the highest line numbers in your main program.

Pascal functions

*D M Woolley,
Hathersage,
Derbyshire.*

MZ-80K

USERS OF SHARP MZ-80K Pascal are probably missing the Set/Reset graphics functions provided by the Basic. This assembly-language program fills that gap. Those with less than 48K will have to adjust the origin appropriately. Here are the instructions:

```
E$CFAA  ; reserve space for routine
Q/      ; return to monitor
LOAD etc. ; load routine from tape and control
            returns to Pascal
```

Set X,Y can now be accessed by Call (−12373) X,Y and Reset X,Y by Call(−12356)X,Y.

It is probably best to incorporate these in procedures to aid clarity and to allow X and Y to be constants, thus:

```
    Procedure Set (X,Y: Integer);
    BEGIN
      CALL (-12373) X,Y
    END;
```

An easier way of converting hexadecimal addresses greater than $8000 to decimal (2's complement) than shown in the Pascal manual is to first convert the hexadecimal directly into decimal, and then to subtract 65536.

Users of Basic SP-5025 may be interested in INP# port, variable and OUT# port, data. These are not in the manual and are the I/O port equivalents of Peek and Poke.

```
                  ;**********************************
                  ;*     SET/RESET                  *
                  ;*  MZ-80K HI-RES GRAPHICS        *
                  ;*     M. WOOLLEY   23/7/82       *
                  ;**********************************
                  ;
                              ORG  0CFA8H
CFA8 C30212                   JP   1202H        ;GOTO PASCAL
CFAB E5          SET:         PUSH HL           ;SAVE X
CFAC D5                       PUSH DE           ;SAVE Y
CFAD CDC6CF                   CALL COMMON       ;COMMON ROUTINE
CFB0 3005                     JR   NC,ADPXL     ;YES,ADD PIXEL
CFB2 78                       LD   A,B          ;GET PIXEL
CFB3 C6F0                     ADD  A,240        ;GEN NEW CHAR
CFB5 1801                     JR   RETURN       ;RETURN
CFB7 B0          ADPXL:       OR   B            ;GEN NEW CHAR
CFB8 77          RETURN:      LD   (HL),A       ;PLOT
CFB9 D1                       POP  DE           ;RESTORE Y
CFBA E1                       POP  HL           ;RESTORE X
CFBB C9                       RET
CFBC E5          RESET:       PUSH HL           ;SAVE X
CFBD D5                       PUSH DE           ;SAVE Y
CFBE CDC6CF                   CALL COMMON       ;COMMON ROUTINE
CFC1 38F5                     JR   C,RETURN     ;NO,RETURN
CFC3 A8                       XOR  B            ;REMOVE PIXEL
CFC4 18F2                     JR   RETURN       ;RETURN
                  ;
                  ;**COMMON ROUTINE**
                  ;
                  ;CALCULATE PIXEL
CFC6 CB45        COMMON:      BIT  0,L          ;IS X EVEN
CFC8 280C                     JR   Z,XEVEN      ;YES,JUMP
CFCA CB43                     BIT  0,E          ;IS Y EVEN ?
CFCC 2804                     JR   Z,YEVEN      ;YES,JUMP
CFCE 1608                     LD   D,8          ;PIXEL IS ■
CFD0 180E                     JR   ADDRES
CFD2 1602        YEVEN:       LD   D,2          ;PIXEL IS ■
CFD4 180A                     JR   ADDRES
CFD6 CB43        XEVEN:       BIT  0,E          ;IS Y EVEN ?
CFD8 2004                     JR   NZ,YODD      ;NO,JUMP
CFDA 1601                     LD   D,1          ;PIXEL IS ■
CFDC 1802                     JR   ADDRES
CFDE 1604        YODD:        LD   D,4          ;PIXEL IS ■
                  ;CALCULATE SCREEN CO-ORDS
CFE0 CB3D        ADDRES:      SRL  L            ;/2 TO GET NEW X
CFE2 CB3B                     SRL  E            ;/2........NEW Y
                  ;CALCULATE SCREEN ADDRESS
CFE4 97                       SUB  A            ;ZERO ACC
CFE5 0608                     LD   B,8          ;LOOP COUNTER
CFE7 0E28                     LD   C,40         ;MULTIPLICAND
CFE9 CB43        MLTPLY:      BIT  0,E
CFEB 2801                     JR   Z,SKIPAD     ;SKIP ADDITION
CFED 81                       ADD  A,C
CFEE CB3F        SKIPAD:      SRL  A
CFF0 CB1B                     RR   E
CFF2 10F5                     DJNZ MLTPLY
CFF4 4F                       LD   C,A
CFF5 42                       LD   B,D
CFF6 51                       LD   D,C          ;DE=Y*40
CFF7 19                       ADD  HL,DE        ;HL=Y*40+X
CFF8 1100D0                   LD   DE,0D000H    ;BASE ADDRESS
CFFB 19                       ADD  HL,DE        ;=SCREEN ADDRESS
                  ;CALCULATE NEW CHAR
CFFC 7E                       LD   A,(HL)       ;GET OLD CHAR
CFFD FEF0                     CP   240          ;CHAR PLOTTED ?
CFFF C9                       RET
                              END
```

Graph screen

*K G Staller,
Birkenhead,
Merseyside.*

VIC-20

THE GRAPH-PLOTTING procedure for the Vic-20 published in April's *Your Computer* produces a graph whose size is limited by the need to cover the whole area of the graph with high-resolution graphics. Here are two programs that overcome this difficulty and produce screen-size graphs.

The first program uses instructions given in *Your Computer* October 1981. These prepare the computer to use high-resolution, user-defined graphics. It also defines the character for axes.

This program, having been Run and Cleared from the computer by typing New, makes way for the graph-drawing program. It produces screen-size graphs by defining new characters only when the line or curve passes through a screen location. Thus most of the screen is filled by blank characters.

The desired functions can be inserted at line 240 as Y = f(x). On Running the program, four input parameters must be given: first, XL — value of X where the plotting of the curve starts; second, XH — value of X where the plotting of the curve ends; third, XM — value of X at the edge of the screen; fourth, YM — value of Y at the edge of the screen.

For XM>XH, XM>XL, and XH>XL care must be taken to avoid trying to plot impossible points, for example, $\sqrt{-1}$ or 1/0.

No compensation is made in the program for the fact that, due to the shape of the screen, n units in the y direction are shorter than n units in the x direction.

I have used this program to draw many different functions on the screen and hope that you find it of interest. I am uncertain as to why what should be one-bit dots on the screen appear as short lines.

```
5 FORI=6176TO7192
6 POKEI,0:NEXTI
10 INPUTXL,XH,XM,YM
20 FORI=0TO7
30 F(I)=2↑(7-I)
40 NEXTI
50 FORI=1TO506
60 POKE7679+I,131
70 POKE38399+I,0
80 NEXTI
90 FORI=1TO22
100 POKE7691+22*I,128
110 POKE7921+I,129
120 NEXTI
130 POKE7933,130
140 CO=0
170 G=11/YM:GG=8*G
180 S=INT((XH-XL)*88/XM)-1
190 XP=XL*11/XM
200 C=7933+INT(XP)
210 D=INT((XP-INT(XP))*8)-1
220 FORI=0TOS
230 X=XL+(I*XM/88)
```

(continued on page 108)

(continued from page 105)

```
240 Y=X↑3-X
250 Y=Y*G
270 IFI=0THENY1=Y
280 D=D+1
290 IFD>7THENC=C+1:D=0
295 IF11<ABS(Y)GOTO380
300 GOSUB1000
380 NEXTI
400 GETA$:IFA$=""THEN400
410 PRINT"[CLR]":END
1000 P=C-22*INT(Y)
1010 Z=PEEK(P)
1030 IFZ>131GOTO1050
1032 K=Z:Z=132+CO:CO=CO+1
1033 IFZ=131GOTO1050
1034 FORJ=0TO7
1035 POKE(5120+8*Z+J),PEEK
     (5120+8*K+J):NEXTJ
1050 E=INT((Y-INT(Y))*8)
1060 ZZ=5127+8*Z-E
1070 POKEZZ,PEEK(ZZ)ORF(D)
1080 POKEP,Z
1090 RETURN
```

Line drawing

Richard Matthews,
Harlow,
Essex.

TI-99/4

EXTENDED BASIC on the Texas TI99/4A computer is easy to use and has many facilities, including sprites. However, one useful facility is lacking: the ability to draw high-resolution lines from point to point on the screen. The program described here allows high-resolution line drawing and is based on the computer's ability to redefine characters.

An important feature of Extended Basic is subroutines that can be called by name at any point in a program. The line-drawing program is written as one of these subroutines so that it can be attached to the end of other programs. The routine may be called at any time by the statement Call Plot RW,CL,RW1,CL1,CT. This would allow a line to be drawn from position RW, row, CL, column, to position RW1, row, CL1, column. The Texas screen has a resolution of 256 by 192 pixels and in this routine screen position 1,1 is in the top left-hand corner.

In simulating a line-drawing function it is necessary to redefine the character allocated to a screen position before each new pixel of a line is plotted. Each character consists of an eight-by-eight matrix of pixels and the character must be redefined to include the newly-plotted point while preserving the existing pattern of that character. Another limitation is the limited number of characters that are available for redefinition. In order to preserve the existing ASCII character set for text it is necessary to start at ASC-96, so this routine should only be used for certain plotting tasks. It is an excellent means of drawing line graphs.

The variable CT in the Call Plot statement is to indicate where within the character set you wish the characters to be redefined. In the example shown, the starting place is ASC-96 and thus CT has the value 96. When 48 characters have been used there are no more available characters to redefine, and so line 275 instructs the program to start again at ASC-96. If more characters are required then CT could be altered to 33, but then the standard ASCII character set will be overwritten. The variable CT need only be set once at the beginning of the program.

Lines 100 to 160 are not part of the line-drawing routine, but are included to show how a line can be plotted. In this example, a line would be drawn from screen position 2, 20 to position 7, 60. The line-drawing routine is called from line 130. Line 190 assigns values to array Bin.

The process for calculating the path to be taken by the line is shown in lines 210 and 240. Line 250 calculates the character position on the screen that contains the pixel which is being plotted. The Texas screen has a character size of 32 by 24.

Line 260 calculates the position within the character of the pixel that is being plotted. Call GChar in line 270 finds out which character already occupies this position on the screen. If that screen position has not yet been used then the ASC value of 32 is returned and this indicates that a new character must be assigned to this position and so CT is incremented by 1. Line 275 checks to see if all the available characters in the character set have been used.

The Call CharPat statement in line 280 — the CharPat sub-program is built into Extended Basic and returns a string that identifies the pattern of a character code — creates in variable x the pattern of the character code found at the screen position already identified.

Lines 290 to 330 modify the character code to allow for the new point that has been plotted. Line 290 identifies the position within the string identified in line 280 of the hexadecimal value that must be modified. Lines 300 to 320 convert this hexadecimal value to a decimal value and the logical operator Or is used in line 310 to redefine the plotted point while preserving the existing pattern of the character.

After conversion back into hexadecimal the string X in line 330 is updated to allow for the change and the new modified character is created and displayed in line 335. The For-Next loop continues until all the points making up a line have been plotted and then control passes back to the main program by way of line 340.

```
60 REM R.MATTHEWS
70 REM TX SOFTWARE
80 REM LINE PLOTTER  (TI99/4A EXTENDED BASIC)
85 REM  ***********
100 CT=96
110 CALL CLEAR
120 READ RW,CL,RW1,CL1
130 CALL PLOT(RW,CL,RW1,CL1,CT)
140 STOP
150 DATA 2,20,7,60
160 END
170 REM ***********
180 SUB PLOT(RW,CL,RW1,CL1,CT)
190 BIN(1),BIN(5)=8 :: BIN(2),BIN(6)=4 :: BIN(3),BIN(7)=2 :: BIN(4),BIN(8)=1
210 X1=RW1-RW :: Y1=CL1-CL :: Z1=MAX(ABS(X1),ABS(Y1)) :: G=RW :: H=CL
240 FOR I=1 TO Z1 :: G=G+X1/Z1 :: H=H+Y1/Z1 :: RW=INT(G) :: CL=INT(H)
```

```
250 CHRW=INT(RW/8.01+1) :: CHCL=INT(CL/8.01+1)
260 PIXRW=RW-((CHRW-1)*8) :: PIXCL=CL-((CHCL-1)*8)
270 CALL GCHAR(CHRW,CHCL,CH) ::IF CH=32 THEN CH=CT ::CT=CT+1 ::CALL CHAR(CH,"")
275 IF CT=144 THEN  CT=96
280 CALL CHARPAT(CH,X$)
290 PS=INT(((PIXRW-1)*8+PIXCL)/4.001)+1 ::CD=ASC(SEG$(X$,PS,1))
300 IF CD<65 THEN DEC=CD-48 ELSE DEC=CD-55
310 DEC=BIN(PIXCL) OR DEC
320 IF DEC>9 THEN CD=DEC+55 ELSE CD=DEC+48
330 X$=SEG$(X$,1,PS-1)&CHR$(CD)&SEG$(X$,PS+1,16)
335 CALL CHAR(CH,X$) :: CALL HCHAR(CHRW,CHCL,CH) :: NEXT I
340 SUBEND
350 REM ***********
READY.
```

Chuff-chuff

G E Malpas,
Little Stoke,
Bristol.

THIS PROGRAM produces a piece of computer-generated animation for the BBC Micro and shows the use of both colour and block graphics in the teletext mode — as featured in June's *Your Computer.*

Lines 10-80 initialise the program and plot the background colour using CHR$(157) which produces a solid line of colour across the screen for the blue of the sky and green of the fields. Line 90 calls a routine to draw clouds in the sky, lines 480-520, and produces between one and eight clouds in random positions in the sky. This creates a different pictures each time the program is run. Line 100 calls a similar routine to draw a hut on the screen.

The main body of the program, lines 100-330, produces the sound effects for the train as it passes across the screen and also produces the control for the speed of the train, lines 140, 190, 270, 320. The position of the train is then plotted using the routine at lines 360-430. Lines 370 and 380 plot a solid line of colour across the screen producing the animated effect. Lines 390 and 400 plot the train itself in red, and then line 420 will produce puffs of smoke from the train at various positions across the screen using the routine ProcChuf.

The overall effect is a very colourful and amusing program. The reader could try adding further items to the scene.

```
5     REM ANIMATED TRAIN
10    MODE 7
20    C = 3
30    FOR X = 1 TO 10
40    PRINT CHR$(&84) CHR$(157)
50    NEXT X
60    FOR X = 11 TO 23
70    PRINT CHR$(&82) CHR$(157)
80    NEXT X
90    PROCCLOUDS
100   PROCHUT
110   FOR L = 20 TO 2 STEP -1
120   SOUND 0,-15,100,L
130   SOUND 0,0,100,L/2
140   C = C + 0.25:PROCTRAIN(C)
150   NEXT L
160   FOR L = 1 TO 40
170   SOUND 0,-15,100,2
180   SOUND 0,0,100,2
190   C = C + 0.25:PROCTRAIN(C)
200   NEXT L
210   SOUND 1,-15,150,20
220   SOUND 1,0,100,10
230   SOUND 1,-15,150,20
240   FOR L = 1 TO 40
250   SOUND 0,-15,100,2
260   SOUND 0,0,100,2
270   C = C + 0.25:PROCTRAIN(C)
280   NEXT L
290   FOR L = 2 TO 20
300   SOUND 0,-15,100,L
310   SOUND 0,0,100,L/2
320   C = C + 0.25:PROCTRAIN(C)
330   NEXT L
340   PRINT TAB(38,24);
350   END
360   DEFPROCTRAIN(C)
370   PRINT TAB(0,15) CHR$(&82) CHR$(157)
380   PRINT TAB(0,16) CHR$(&82) CHR$(157)
390   PRINT TAB(C,15) CHR$(&91)"kpt"
400   PRINT TAB(C,16) CHR$(&91)"o/?"
410   IC = INT(C)
420   IF IC = 5 OR IC = 10 OR IC = 15
      OR IC = 25 OR IC = 30 OR IC = 3
      OR IC = 32 THEN PROCCHUFF(C)
430   ENDPROC
440   DEFPROCCHUFF(C)
450   PRINT TAB(0,14) CHR$(&82) CHR$(157)
460   PRINT TAB(C+1,14) CHR$(&97)"e"
470   ENDPROC
480   DEFPROCCLOUDS
490   FOR Q = 1 TO RND(8)
500   PRINT TAB(RND(30) + 3,RND(8)) CHR$(&97)"N¾C"
510   NEXT Q
520   ENDPROC
530   PROCCHUT
540   PRINT TAB(30,11) CHR$(&91)"xt"
550   PRINT TAB(30,12) CHR$(&93)"'/"
560   ENDPROC
```

Lissajous effect

Stephen K Wilson,
Oakes,
Huddersfield.

WHEN TWO sets of waves produce a geometrical shape a Lissajous figure is created. This program simulates this effect as produced on an oscilloscope screen. With the instrument's time-base off, one oscillating signal is connected to the X plate and one to the Y plate. If the frequencies of these signals are in a simple ratio a recognised symmetrical figure is formed. In physics these figures are used for determination of an unknown frequency through comparison with a known one. The nature of the figure depends on the path difference between the signals. With the simplest of all ratios — 1:1 — the figure is a sloping line with a path difference of 0 rads, a sloping ellipse with a path difference of one quarter of the rads, and a circle with a path difference of half of π.

In this simulation the user is asked to input the ratio of frequencies in lowest terms, and the path difference between the signals — X signal leading Y signal — as a fraction of π. The computer calculates and draws the figure.

The program will run on either BBC model, though those with model Bs would wish to alter line 15 to run it in mode zero for greater

(continued on next page)

(continued from previous page)
resolution. Those with greater patience and a greater desire for accuracy might wish to reduce the Step command at line 100.

With a view to converting to other Basic dialects it is worth mentioning that @% is a formatting feature which displays all figures to two decimal places. The VDU 28 call defines a text window at top-centre screen which is cleared by the VDU 12 call and cancelled with VDU 26, line 95. *FX 15,0 clears the keyboard buffer, line 25.

```
10    REM: LISSAJOUS FIGURES by S.WILSON
15    MODE4: @%=131594:PROCDISPLAY
20    PROCPLOT
25    *FX15,0
30    PRINT TAB(6,30)"Do you wish to re-run ";:INPUTA$
35    A$=LEFT$(A$,1):IFA$= "Y" THEN GOTO 15
40    @ = 2570: CLS: END
45    DEFPROCDISPLAY
50    PRINT TAB(8,1)"LISSAJOUS FIGURES":PRINT TAB(8,2)STRING$(18,"_")
55    VDU28,0,7,39,4:INPUT TAB(4)"X-plate signal frequency ",XF
60    INPUT TAB(4)"Y-plate signal frequency ",YF:INPUT TAB(2)"Path
      difference (fraction of PI) ",PD
65    VDU12
70    IF PD>=1 THEN PD = PD - INT(PD)
75    ENDPROC
80    DEFPROCPLOT
85    MOVE300,250: DRAW800,250:DRAW800,750:DRAW300,750:DRAW300,250
90    PRINT TAB(5)"Ratio of frequencies ";XF;":";YF:PRINT TAB(6)
      "Path difference ";PD*PI;" radians"
95    VDU26
100   FOR A = -PI TO PI STEP 0.01
105   XX = 250*SIN(A*XF + PD*PI) + 550
110   YY = 250*SIN(A*YF) + 500
115   IF A = -PI THEN MOVE XX,YY ELSE DRAW XX,YY
120   NEXT
125   ENDPROC
```

Program name

Alan Went,
Colchester,
Essex.

ZX-81

EVERYONE MUST at some time have recorded a program on tape and forgotten to label the cassette. To find out what the program is, it must be loaded, which on the ZX-81 with a full 16K program can take 10 minutes. This routine, which takes up about 90 bytes, will read the name that you gave the program, in a few seconds, without loading it, and without destroying the existing program.

The routine is a modified version of the ZX ROM Load routine, but whereas the ROM only uses the name to compare the program on tape against the program name given after Load. I have modified it to print the name on the screen.

Line 1 consists of a Rem line containing 74 characters into which Lines 10 to 70 Poke the machine-code routine. After running the program as listed Lines 10 to 70 should be deleted and Line 10 added:

10 RAND USR 16514

To use the routine start the tape-player then Run. The normal waiting-to-load pattern will appear on the screen. A few seconds after the program load patterns appear, the program will stop with the program name on the screen.

It is advisable to keep the name as short as possible but up to 90 characters can be used.

Note that Line 10 in machine-code loader is:

10 LET A$ = "CD230FCD8A4018FB0E0106003E7FDBFED3FF1FD2A2031717381110F1F1CD8A40CB7A792001D71730F4181DD51E94061A1DDBFE17CB7B7B38F510F5D12004FE5630C83FCB1130C3C9C9S"

After running the program as listed, replace Lines 10 to 70 with:

10 RAND USR 16514

```
   1 REM LN ??LN ▒RND/ CLS  :▘▞ Y
▒<= RETURN PEEK COPY 3ABS ▒▔**S)
( LET LET LN ▒RNDACS ??4▘NOT *K
POKE /1STR$ 2▒▘,1<= RETURN *ACS
??S PRINT ( PRINT SGN 4▖ RETURN
?KCOS ZACS )K?TAN TAN
  10 LET A$="CD230FCD8A4018FB0E0
106003E7FDBFED3FF1FD2A2031717381
110F1F1CD8A40CB7A792001D71730F41
81DD51E94061A1DDBFE17CB7B7B38F51
0F5D12004FE5630C83FCB1130C3C9C9S
"
  20 LET X=16514
  30 IF A$="S" THEN STOP
  40 POKE X,16*CODE A$+CODE A$(2
)-476
  50 LET X=X+1
  55 PRINT A$( TO 2);"  ";
  60 LET A$=A$(3 TO )
  70 GOTO 30
```

Spiral clear

Gary Nugent,
Churchtown,
Dublin, Eire.

ZX-81

SPIRAL CLS was written for a 16K ZX-81. It clears a 22 by 32 screen. The screen is first filled by a spiral of inverse spaces, and then by a spiral of spaces. The screen is then ready for output, the Print position having been reset to 0,0.

The routine is in machine code and is 91 bytes long. It should be entered into a line 1 Rem statement using any of the hexadecimal loaders that have been in previous issues of *Your Computer*. The code is not relocatable. Should you wish to move it, all the Call addresses will have to be changed.

This is a novel way to clear the screen and is faster than the system CLS when large amounts of memory and Scroll are in use.

Poking address 16599 with a value less than 192 increases the speed of the spirals. A larger value decreases the speed. To make the routine clear a 24 by 32 screen, do as direct commands:

POKE 16535,23 (21 for 22×32 screen)
POKE 16575,9 (11 for 22×32 screen)

The routine is called by Rand USR 16514.

```
3E 80               LD A,80
CD 93 40            CALL SPIRAL
3E 00               LD A,00
CD 93 40            CALL SPIRAL
01 00 00            LD BC,0000
CD F5 08            CALL PRINT AT
C9                  RET
2A 0C 40   SPIRAL   LD HL,(D-FILE)
0E 15               LD C,15
06 20               LD B,20
50         AGAIN    LD D,B
23         LOOP 1   INC HL
77                  LD (HL),A
CD D5 40            CALL PAUSE
15                  DEC D
20 F8               JR NZ,LOOP 1
05                  DEC B
59                  LD E,C
C5                  PUSH BC
01 21 00            LD BC,0021
09         LOOP 2   ADD HL,BC
77                  LD (HL),A
CD D5 40            CALL PAUSE
1D                  DEC E
20 F8               JR NZ,LOOP 2
C1                  POP BC
0D                  DEC C
50                  LD D,B
2B         LOOP 3   DEC HL
77                  LD (HL),A
CD D5 40            CALL PAUSE
15                  DEC D
20 F8               JR NZ,LOOP 3
5F                  LD E,A
78                  LD A,B
FE 0B               CP 0B
C8                  RET Z
7B                  LD A,E
05                  DEC B
59                  LD E,C
C5                  PUSH BC
01 21 00            LD BC,0021
ED 42      LOOP 4   SBC HL,BC
77                  LD (HL),A
CD D5 40            CALL PAUSE
1D                  DEC E
20 F7               JR NZ,LOOP 4
C1                  POP BC
0D                  DEC C
18 C5               JR AGAIN
F5         PAUSE    PUSH AF
3E C0               LD A,C0
3D         LOOP 5   DEC A
20 FD               JR NZ,LOOP 5
F1                  POP AF
C9                  RET
```

Double-height

Paul Evans,
Clapton-in-Gordano,
Avon.

SPECTRUM

THIS PROGRAM produces double-height characters from a 48K Spectrum.

Line 5 changes RAMtop to reserve memory for the new character sets. There are two new sets, one for the top half of each character, and one for the bottom half.

Lines 10 to 110 load the two character sets above RAMtop. This part of the program only needs to be run when the program is loaded: it does not have to be run each time a double-height character is printed.

Lines 9800 to 9920 print out text contained in a$ in double-height characters. Note that a$ should contain only ASCII characters, i.e., those with a value less than 128.

If you own a 16K Spectrum the following changes have to be made: 63830 in line 5 has to be altered to 31062; 63831 in lines 100 and 9820 changes to 31063; and 64599 in line 9830 changes to 31831. To print the text loaded into a$ type Gosub 9800.

I have discovered that the command Open# 2,"p" causes all text created by a Print statement or List command to be diverted from the TV screen to the printer. Sometimes this is more useful than keying LPrint to use the printer. The statement Close# 2 makes things revert to normal.

```
   1 REM *** Double height ***
   5 CLEAR 63830
  10 FOR x=0 TO 95
  20 FOR c=0 TO 3
  30 POKE FN a(0),FN b(0)
  40 POKE FN a(1),FN b(0)
  50 POKE FN a(768),FN b(4)
  60 POKE FN a(769),FN b(4)
  70 NEXT c
  80 NEXT x
  90 STOP
 100 DEF FN a(z)=z+2*c+x*8+63831
 110 DEF FN b(z)=PEEK (15616+x*8+c+z)
9800 DIM p$(32)
9810 LET p$=a$
9820 LET chars=63831: GO SUB 9900: PRINT p$
9830 LET chars=64599: GO SUB 9900: PRINT p$
9840 IF LEN a$<=32 THEN LET chars=15616: GO SUB 9900: RETURN
9850 LET a$=a$(33 TO )
9860 GO TO 9800
9900 POKE 23606,chars-256*INT (chars/256)
9910 POKE 23607,(INT (chars/256))-1
9920 RETURN
```

Magic circle

Stephen Skinner,
Billingham,
Cleveland.

DRAGON

THIS PROGRAM for the standard 32K Dragon demonstrates the use of the circle command. Four circles are drawn, each at a 90° displacement. In turn, each radius of the four circles decreases by a small amount until they form point. Sound is also included to add a bit of sparkle to the demonstration.

```
30 A=135:B=255:PMODE4,1
40 PCLS:SCREEN1,1:X=211
50 Y=96:R=443:X1=44
60 Y1=96:R1=43:X2=128
70 Y2=43:R2=43:X3=128
80 Y3=149:R3=43
90 CIRCLE (X,Y),R
100 CIRCLE (X1,Y1),R1
110 SOUND A,1:A=A+2
115 SOUND A+1,1
120 CIRCLE (X2,Y2),R2
130 CIRCLE (X3,Y3),R3
140 SOUND B,1:B=B-2
145 SOUND B-1,1
150 X=X-4:X1=X1+4:R=R-1
:R1=R1-1:Y2=Y2+3:R2=R2-1
:Y3=Y3-3:R3=R3-1
160 IF Y2>169 THEN 180
170 GOTO 90
180 FOR M=3 TO 4
190 FOR D=1 TO 700:NEXT
D:PMODE M,1:SCREEN 1,0
195 NEXTD
200 NEXT M
210 GOTO 180
```

Mystery

Allister Dann,
Sleaford,
Lincolnshire.

ZX-81

THESE PROGRAMS are for the 1K ZX-81 alone. Tempting as they might seem to 16K owners, the RAM pack must be removed.

Program 1 should be entered first and then Run. When the inverse L appears, enter 62,-166,237,71,201 where the commas represent Newline.

You will have to try it to see what this program does, because it is very hard to describe. Suffice to say it produces graphics never before seen on a ZX-81.

Enter program 2 very carefully, and use Run 100.Then,wait. The screen is filled with peculiar characters. Wait until three-quarters of the screen is filled, and then Wham!

To revert to the normal graphics mode, use New. Repeat this procedure, changing the -166 to -122 for even more spectacular results.

The cleverer ones amongst you will have realised that program 1 can be entered as a series of direct Poke commands. The format I have used is simply the one I like best. For fun, trying changing the -122 to another number.

Program 3 was discovered by accident. The Poke command gives you 34 columns as opposed to the standard 32. Use line 1 with other programs to increase screen size.

```
10 FOR A = 17000 to 17004
20 INPUT I
30 POKE A,I
40 NEXT A
50 LET C = USR 17000
Enter 62,-166,237,71,201.
```

Program 1.

```
100 LET A = INT(RND*255) + 1
200 PRINT CHR$ A;
300 GOTO 100
```

Program 2.

```
10 POKE 16441,20
20 PRINT "AB"
30 GOTO 10
```

Program 3.

Scroll clear

Ian Bland,
Northampton.

ZX-81

WHILE MESSING AROUND with my 16K ZX-81 I found a way to make the screen Clear quickly after Scrolling. Normally, a CLS command or a return to non-Scrolled Printing takes a long time because the display has to be padded out with spaces on the expanded machines. This program will illustrate this:

```
10 FOR N = 1 TO 22
20 SCROLL
30 PRINT "TEST"
40 NEXT N
50 CLS
```

See how long the CLS command takes. The trick is to artifically pad the display file on each scroll, by using a Tab to move the Print position to the end of the line. To show this, change line 30 in the program to:

```
30 PRINT "TEST"; TAB 31;
```

and Run the program again. By forcing the ZX-81 to print a full line of 32 spaces each time, the display file remains intact. ■

MEMOTECH Explores the Excellence of your ZX81



MEMOTECH KEYBOARD
including separate buffered interface
only
£34.70 plus VAT

NEW - Memotech's Plug-in ZX81 Keyboard

- Plugs simply into system without modifications to your ZX81
- Keys have Sinclair legends
- High quality typewriter keys
- Does not inhibit other add-ons
- Automatic hold-down repeat
- Complete with buffered interface
- Fast and easy entry
- Switchable between configurations

Memotech's Memopak Range

Current Memopaks
16K
32K
64K
HRG
Centronics Interface

MEMOPAK 64K MEMORY EXTENSION

The 64K Memopak extends the memory of the ZX81 by 56K, and with the ZX81 gives 64K, which is neither switched nor paged and is directly addressable. The unit is user transparent and accepts commands such as 10 DIM A(9000).

Breakdown of memory areas...0-8K Sinclair ROM. 8-16K This area can be used to hold machine code for communication between programmes or peripherals. 16-64K A straight 48K for normal Basic use.

MEMOPAK 32K and 16K MEMORY EXTENSIONS

These two packs extend and complete the Memotech RAM range (for the time being!) A notable feature of the 32K pack is that it will run in tandem with the Sinclair 16K memory extension to give 48K RAM total.

MEMOPAK HIGH RES GRAPHICS PACK

HRG Main Features — • Fully programmable Hi-Res (192 × 248 pixels) • Video page is both memory and bit mapped and can be located anywhere in RAM. • Number of Video pages is limited only by RAM size (each takes about 6.2K RAM) • Instant inverse video on/off gives flashing characters • Video pages can be superimposed • Video page access is similar to Basic plot/unplot commands • Contains 2K EPROM monitor with full range of graphics subroutines controlled by machine code or USR function

MEMOPAK CENTRONICS TYPE PARALLEL PRINTER INTERFACE

Main Features — • Interfaces ZX8I and parallel printers of the Centronics type • Enables use of a range of dot matrix and daisy wheel printers with ZX8I • Compatible with ZX8I Basic, prints from LLIST, LPRINT and COPY • Contains firmware to convert ZX8I characters to ASCII code • Gives lower-case characters from ZX8I inverse character set



© R. Branton & G.A.C. Boyd 1982

Coming Soon..

RS232 Interface

Digitising Tablet

We regret we are as yet unable to accept orders or enquiries concerning the above products, but we'll let you know as soon as they become available.

Please make cheques payable to **Memotech** Ltd.

Please Debit my Access/Barclaycard* account number

Please send me	Price	No	Total
64K RAM £68.70+£10.30 VAT	£79.00		
32K RAM £43.43+£6.52 VAT	£49.95		
16K RAM £26.00+£3.90 VAT	£29.90		
HRG £52.00+£7.80 VAT	£59.80		
CENTRONICS I/F £34.70+£5.20 VAT	£39.90		
MEMOTECH KEYBOARD PLUS I/F £34.70+£5.20 VAT	£39.90		
Packaging & Postage £2.00 per unit (UK), £3.00 (overseas)			
TOTAL ENC			

*Please delete whichever does not apply

SIGNATURE ______ NAME ______

ADDRESS ______ DATE ______

Access Barclaycard Holders Please Tel. Oxford (0865) 722102 (24 Hrs)

We want to be sure you are satisfied with your Memopak — so we offer a 14-day money back Guarantee on all our products.

Memotech Limited, 3 Collins Street, Oxford OX4 1XL, England Tel: Oxford (0865) 722102 Telex: 837220 Orchid G

CAT-FIGHTER

BY ANTHONY ROBERTS

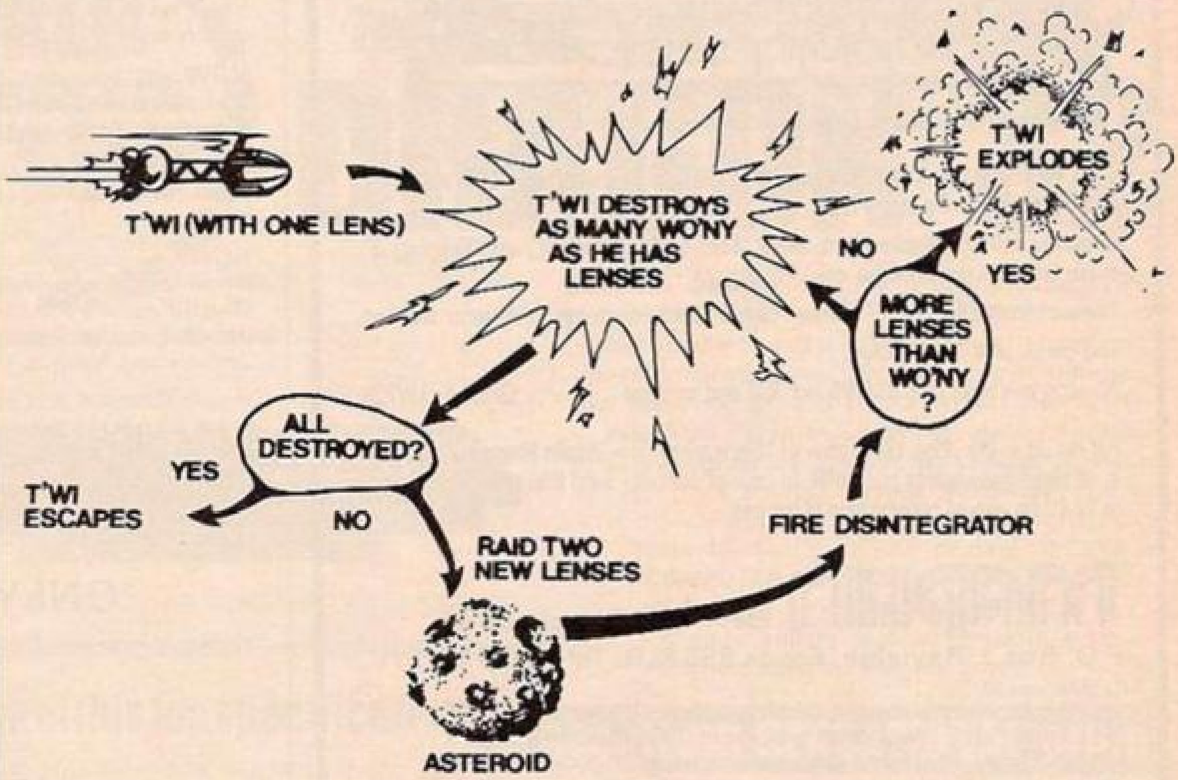
CAPTAIN T'WI is on a suicide mission inside the automated Wo'ny defence zone, with the entire force of between 2,000 and 2,100 homing cat-fighters after him.

T'wi has only a single-lensed F'lix disintegrator to start with, but fortunately every time it is used to destroy a cat-fighter the resultant sub-etheral interference disables the rest of the force just long enough for T'wi to raid the Wo'ny supply asteroid and pick up two more lenses and fix them to his disintegrator. The weapon will destroy as many cat-fighters as it has lenses. Unfortunately, any lens not aimed at a cat-fighter, but which hits one, automatically self-destructs — taking everything within 100 square AUs with it. Two lenses aimed at the same cat-fighter have the same effect.

Of course, T'wi makes it out after totally destroying the cat-fighter force; and gets the maximum number of precious F'lix lenses: how many cat-fighters, and lenses? Here's a chart of the action.

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in November. The name of the winner, the solution, and a competition report will be published in the January, 1983 issue of *Your Computer.*

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.



Competition results

WE RECEIVED more than 100 correct entries for September's Jailbreak problem — considerably more than in previous months. There were in fact three solutions: entry at 00.03 hours for an escape with one prisoner, entry at 00.21 hours for two prisoners, entry at 15.40 for three prisoners. Most people reasonably assumed that the preferred solution was the one in which the most prisoners were released.

Some entries took a mathematical approach, based on the fact that the number of beads must be the sum of an arithmetical progression. But most programs simply searched for those times that fulfilled all the conditions.

We considered programs that contained two loops, for hours and minutes, neater than programs that used a single loop, Time = 0 to 23.59, since the latter tests non-existent times like 12.70.

From the handful of entries which took the first line we awarded the £15 book token to S Beadle, 44 Mendip Avenue, Hillcroft Park, Stafford ST17 0PG. He noted that his ZX-81 took just over eight minutes to solve the problem in Fast mode.

Our September competition for a NewBrain computer asked entrants to complete the sentence "I need a Newbrain because . . ." and large number of entries complained that their old brains were worn out with the effort of solving the crossword. Other pleas were that their brains were too small, unable to cope, storm-damaged, jaded, bug-ridden, out of memory, over-taxed and crashed.

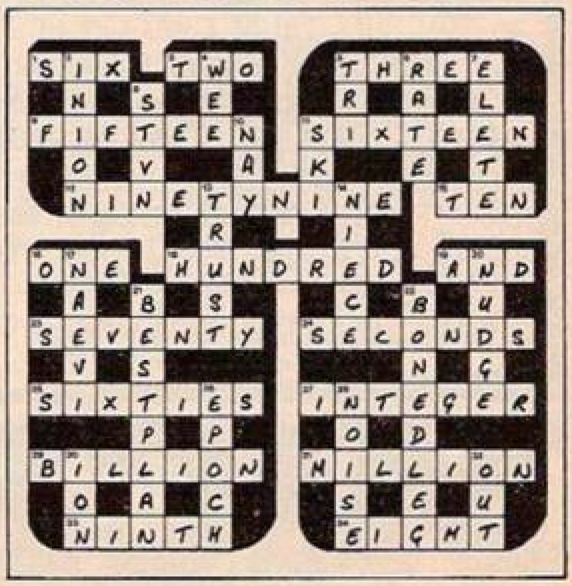
A Morgan put it this way: "My old brain can't take the strain of failing again"; while C Shires reported with disarming candour "My present one cannot think up witty slogans to win competitions". Moved by such plaintive cries, we gave the prize to M White, 41 Monville Road, Fazakerley, Liverpool L9 9DE, who wrote "It's probably my last chance to get a head in computing".

Several people needed a NewBrain because as P Marfell said "This is the age of the Brain"; D Lewis confessed "I have a mania for such crania" and D Bull revealed that "Igor dropped the last one on the laboratory floor".

```
5    REM JAILBREAK SOLUTION BY S.BEADLE
10   FOR H = 1 TO 24
20   FOR M = 0 TO 59
30   LET P = 1
40   LET G = 0
50   LET B = M + 100*H
60   LET B = B - G
70   IF B > 0 THEN GOTO 200
80   IF B = 0 THEN GOTO 100
90   LET G = G + 1
95   GOTO 60
100  LET P = P + 1
110  IF P = G THEN GOTO 150
120  LET B = G
130  LET G = 0
140  GOTO 60
150  PRINT H;"HRS.";M;"MINS.";P;"PRISONERS"
160  STOP
200  NEXT M
210  NEXT H
VARIABLES: M = MINUTES     H = HOURS  G = GOLD COINS
           B = BEADS       P = PRISONERS
```

S Beadle's program to solve the Jailbreak problem.

Solution to the September crossword.





Keyboard with Electronics for ZX81

A full-size, full-travel 43-key keyboard that's simple to add to your ZX81 and requires no soldering in the ZX81.

Complete with the electronics to make "Shift Lock", "Function", and "Graphics 2" single key selections making entry far easier.

Powered from ZX81's own standard power supply – with special adaptor supplied.

Two-colour print for key caps.

Amazing low price only **£19.95** incl. VAT and carriage. Order As LW72P

Full details in the June 1982 issue of "Electronics – The Maplin Magazine" on sale at all good newsagents price 60p. In case of difficulty send 60p to address below, or £2.40 for annual subscription (4 issues).

MAPLIN Electronic Supplies Ltd

P.O. Box 3, Rayleigh, Essex SS6 8LR. Tel (0702) 552911

Retail shops at
159 King St., Hammersmith, London W6. Tel 01-748 0926
284 London Road, Westcliff-on-Sea, Essex. Tel (0702) 554000
Lynton Square, Perry Barr, Birmingham. Tel: (021) 356 7292
(Shops closed Mondays). All mail to Rayleigh address.

PASCAL FOR THE ZX SPECTRUM

Hisoft are pleased to announce the availability of Hisoft Pascal 4 for the 48K ZX SPECTRUM.

No longer do you have to put up with the slow execution speed of BASIC programs; Hisoft Pascal 4 produces programs that run between 40 and 100 (yes 100!) times faster than the equivalent programs written in ZX SPECTRUM BASIC. For example, a program to sort a 100 element array of numbers into ascending order takes 60 seconds in BASIC, while HP4 produces a program which does the same thing in 0.6 seconds!

NOW you and your children can learn to program in an efficient and structured way by using Pascal, the favoured language in schools and universities.

NOW you can write games programs etc. which run as fast as you need them to without having to resort to assembler or machine code.

NOW you can use a language which requires minimal re-learning when you move from your SPECTRUM to another computer; Hisoft Pascal 4 has all the essential features of Standard Pascal as detailed in the Pascal User Manual and Report — by Kathleen Jensen and Niklaus Wirth, the man who designed Pascal.

Hisoft Pascal 4 is a professional piece of software designed by a team who have been writing Pascal compilers for many years — you will find it to be powerful, flexible and very easy to use.

To top it all, we are offering the package (which includes a 60 page manual), for a limited time, to 48K ZX SPECTRUM users at an INCREDIBLE price of:

ONLY £25 INCLUSIVE

Write for more details TODAY to:

HISOFT
60 Hallam Moor
Liden SWINDON
SN3 6LS

Tel. (0793) 26616 (Answering machine)

MICROWARE – UNIT 5, ST. PETERS LANE, LEICESTER. Tel: 0533 681812

NOTE OUR NEW ADDRESS (Close to Clock Tower, Large Car Parks and Bus Station)

THE "FRIENDLY TO USER STORE" THE FIRST MIDLANDS REGION RETAIL SHOP SPECIALISING IN SINCLAIR COMPUTER ACCESSORIES

ZX81 NOW IN STOCK £49.95

AND "WELCOME" THE NEW DRAGON 32 AVAILABLE NOW £199.50

ALSO SUPPORTING SOFTWARE AND HARDWARE

Come and see our ever increasing range of Software · Hardware · Books · Magazines · Keyboards · Ram Packs · Graphic Roms · I/O Ports · etc.

Reliable Cassette Player – tested for loading/saving on ZX81, SPECTRUM, DRAGON, BBC ONLY £18.50

SOFTWARE & BOOKS FOR BBC and VIC 20.

IF THE PRODUCT IS GOOD AND THE PRICE IS RIGHT – THEN MICROWARE STOCK IT!

STOCKISTS OF DEAN ELECTRONICS and D.K. 'TRONICS **SUPERB** KEYBOARDS FOR ZX81 **AND** (SPECTRUM – D.K. 'TRONICS)

MICROWARE SOFTWARE

ALIEN COMMAND (16k) Testing Invaders style game making full use of Spectrum sound, colour and graphics £5.50 SPECTRUM

BACKGAMMON (16k) Play against your computer in this version of the popular board game £5.00 SPECTRUM

BOTH GAMES AVAILABLE FROM SHOP OR MAIL ORDER

SOFTWARE WRITERS!
GOOD SPECTRUM or DRAGON SOFTWARE WANTED – EXCELLENT ROYALTIES

We apologise for delay in sending out catalogues – we are currently re-printing due to much new stock.

TRADE ENQUIRIES WELCOME OPEN 9.30 – 12 noon 12.30 – 5.30 pm Closed Monday SAE BRINGS CATALOGUE

SEE US AT THE NORTHERN COMPUTER FAIR – BELLE VUE, MANCHESTER, STAND V2 AND V3

MICROWARE Leicester

spectrum

We won't be be beaten on price!

SPECTRUM is a rapidly expanding group of independent retailers who specialise in selling home computers. Our group policy is simple – **WE WON'T BE BEATEN ON PRICE!** – our **BULK BUYING** ensures this. We select and buy the best and pass the savings on to **YOU**, the customer. We **GUARANTEE** that if you find an item currently advertised and in stock at another dealer and at a better price than ours – **WE WILL MATCH THAT PRICE ON THE SPOT.**

Only trained personnel at Spectrum!

We believe that our product **'know-how'** is crucial to you the customer. That's why in every one of our centres you'll find **fully trained personnel**, who have been **trained by the importers or distributers themselves** – so we **know** and **understand** the products we sell and can help every customer even the complete beginner. At **SPECTRUM** we find the **RIGHT** equipment to suit your needs. Handing over sealed boxes is not our line – our service includes **'hands-on' experience** that we pass on to **YOU.**

After Sales care

SPECTRUM service centres will ensure that should your machine 'go-down' **we will get it running again as quickly as possible.** We also offer **extended warranties** at reasonable prices too! – ask your **SPECTRUM HOME COMPUTER CENTRE** for full details.

Shop News!

New Spectrum Centres

CANTERBURY
MANCHESTER
PAIGNTON
PRESTON
STAFFORD

Don't miss Fisher's

COMPUTER SHOW

to be held at the

LADBROOK MERCURY HOTEL Basingstoke on OCTOBER 21st

from 4 p.m. - 9 p.m.

ADMISSION FREE! - TICKETS AVAILABLE

COMPUTER DEALERS!

(or prospective Computer Dealers!) If you would like to know more about becoming a **SPECTRUM APPOINTED DEALER** on an **exclusive area basis,** please contact **MIKE STERN** or **ALAN WARREN** on **(0727) 66646.**

Spectrum (U.K.) Ltd., Unit 6, Marlborough Trading Estate, Lattimore Road, St. Albans, Herts.

FREE! CASSETTE Worth £7.95 with every **DRAGON** purchased – use your FREE OFFER COUPON! Offer exp. 15.11.82

Fantastic Value for money!

DRAGON 32



Enter the **DRAGON!** – this really is **unbelievable value at only £173** from **SPECTRUM!** British built and designed, it's one of the **most impressive micros** to appear for quite some time. Featuring as standard a **32K RAM** (expandable to 64K Bytes) **plus** it offers **extensive facilities** including **highly advanced colour graphics** for **graphs, cartoon animation** etc. It's the ideal **'Family Computer'** and will provide hours of fun and education for **YOUR** family! – see it at your nearest **SPECTRUM COMPUTER CENTRE** now. But just one word of warning – at this **amazing price** they're already **selling fast** so make it soon, or **phone** before making a journey.

Just look at this top specification

- Powerful standard 32K RAM (expandable to 64K Bytes).
- 9 Colour, 5 resolution Display.
- Extended Microsoft colour BASIC (as standard).
- Advanced sound with 5 octaves – 255 tones.
- Professional style editing, e.g. extract line, auto find reinsert.
- Professional quality keyboard.
- Centronics Paralled printer interface.
- Serious programmer/user – the BASIC on this machine is similar to that found on machines costing 3 times the price!
- Uses almost any cassette recorder.
- Standard file handling ON TAPE.

Spectrum SENSATIONAL price

£173.00

PRICE INC. VAT £198-95

SOFTWARE for DRAGON 32

Joysticks (pair)	£17.35
Cassette lead	£2.35
CARTRIDGES	
Beserk	£17.35
Cosmic Invaders	£17.35
Meteroids	£17.35
Ghost Attack	£21.70
	EX. VAT
CASSETTES	
Computarvoice	£6.91
Graphic Animator	£6.91
Quest	£6.91
Madness and the Minotaur	£6.91
Selection of Games	£6.91
Selection of Utilities	£6.91
Examples from Dragon Manual	£6.91
Personal Finance	£6.91
Seikosha GP100A printer for Dragon	£189.00
Printer cable	£19.09

Above prices excluding VAT.

Great Value from Spectrum!

SEIKOSHA GP-100A

Graphic Printer

FREE! PAPER Worth £11.95 with every SEIKOSHA purchased – use your Free Offer Coupon! Offer exp. 31.10.82



Now a top quality graphic printer **at a price you can afford.** The **SEIKOSHA GP-100A – Terrific value** at under **£200** from **SPECTRUM.** Standard Centronics compatable interface for easy link-up with most micros. ■ Full graphics capability. ■ Printing speed 30 chars/sec. ■ Double width character output under software control. ■ Graphics, character and double width character can be intermixed on same line ■ Paper width adjustable up to 10" – tractor feed. ■ Print position addressable by character or dot.

Spectrum LOW price £189.00

Price Inc. VAT £217.35

Also available: **SEIKOSHA GP-100VC** (Built exclusively for VIC-20) ONLY £199.00 Ex. VAT (£228.85 Inc. VAT)

Optional Interfaces for GP-100A/GP-100VC

	Ex. VAT	Inc. VAT
RS232	£70.00	£80.50
MZ80-A	£60.00	£69.00
APPLE SERIAL	£45.00	£51.75
APPLE GRAPHIC	£55.00	£63.75
VIDEO GENIE	£36.00	£41.40
Cables for BBC MICRO, ACORN, DRAGON	£19.09	£21.95

Arriving soon! New GP250X 50cps printer £230 Ex.VAT

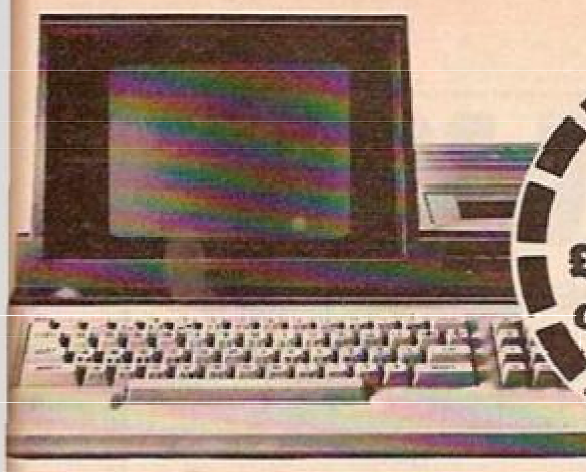
FREE OFFER COUPON

To claim any of the **FREE OFFERS featured** in our advertisements, present this coupon **at time of purchase,** and your **SPECTRUM** dealer will give you the **FREE** goods **relating to the purchase.**

Offers extended until 15.11.82 & apply to featured free offers only.

See next page

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.



FREE!
£75 WORTH of software
with every **MZ80A** purchased

SHARP MZ-80A

Desk top genius! – the all-in-one **SHARP MZ-80A**. A personal computer designed with the serious user in mind, **ready to run the moment you get it home**. Built-in keyboard, CRT 9" display and cassette data storage with **48K RAM**. The BASIC with extra useful additions, offers quite a powerful micro for the home or business. ■ 4K Byte ROM + 48K Byte RAM + 2K Byte Video RAM ■ ASCII profiled keyboard + numeric pad ■ 2 page Video RAM allows screen to be scrolled up or down. ■ CP/M available.

Spectrum LOW price £475.00

Price inc. V.A.T. £546.25

MZ Software from KUMA

Pakman (48K)	£8.00
Asteroids	£8.00
Frogger	£8.00
Chess	£14.00
Cribbage	£10.50
Adventure	£10.50
Tombs of Karmak	£8.00
Map of U.K.	£10.50
Music Composer	£10.50
Junior Maths	£5.50
Home Budget	£5.50
Word Pro (Cass)	£39.50
Word Pro (Disk)	£79.95
Data Base (Cass)	£29.50
Data Base (Disk)	£59.50

All KUMA prices excluding V.A.T.

SHARP PERIPHERALS FOR MZ80A	EXC. VAT	INC VAT
Twin floppy disk unit (5¼")	£590.00	£678.50
Single floppy disk unit	£400.00	£460.00
Floppy disk interface card	£100.00	£115.00
Floppy disk cable	£24.00	£27.50
Master diskette and manual	£31.00	£35.66
Expansion unit (disk drive or printer)	£100.00	£115.00

SHARP HAND HELD COMPUTERS

Pocket-sized genius at your command – we sell the well established PC1211 & the new 1500 Models.

SHARP PC1211 £65.00 Ex. VAT
(£74.75 inc. VAT)



SHARP PC1500 £147.48 Ex. VAT
(£169.95 inc. VAT)



PC 1500 Printer/cassette interface	£130.39	£149.95
PC 1500 4K RAM upgrade	£43.43	£49.95

Attention real computer enthusiasts!

NASCOM Special Edition



Are you a real computer enthusiast? If you're looking for a machine to take you **way beyond** the sphere of a normal domestic computer you need go no further than the **NASCOM SPECIAL EDITION.** To give you some indication of its scope it's already been adopted for many commercial applications including **Hotel Booking Systems, Blood Grouping, Weaponary and Satellite Tracking** etc. ■ **Programmable in BASIC and machine code** ■ **8K Memory expandable easily to 56K with plug-in board** ■ **Facility for up to 206K onboard memory** ■ **Super colour graphic facilities** ■ **Full range of disk drives, printers and various input/output facilities can be added** ■ **Supplied complete with Mains Lead & Plug, TV, Monitor & Tape Recorder connections.**

SINCLAIR ZX81

Now available from
SPECTRUM COMPUTER CENTRES

	Inc. VAT
SINCLAIR ZX81	£49.95
16K RAM Pack	£29.95
ZX Printer	£59.95

Cassettes available from **£3.95** – please see your local **SPECTRUM** dealer for further details.

Spectrum LOW Price

£429.95 EX. VAT

(£494.44 Inc. VAT – Prince monitor illus. extra)

NASCOM Special Edition **48K Ram Board £130.00** ex. VAT (£149.50 inc. VAT)

SAVE £15 on the **PRINCE MONITOR** when purchased together with the
NASCOM SPECIAL EDITION

EPSON PRINTERS

FREE! PAPER Worth £11.95

Chosen by SPECTRUM for their reliability, the superb **new top quality** graphic printers from **EPSON**. New features include **super & subscript, underlining & deletion**. *If you're looking for an **up-market** printer at a* **down-to-earth-price**, call in and see the **EPSON** range at **SPECTRUM**.



Model	EX. VAT	INC. VAT
MX80-T3	£299.00	£343.85
MX80 F/T Type III	£335.00	£385.25
MX100 Type III	£429.00	£493.35

Please see your SPECTRUM dealer for prices of INTERFACE/CABLE options.

There's a SPECTRUM CENTRE near you . . .

ALFRETON
Gordon Harwood
69/71 High Street,
Alfreton, Derbyshire
Tel: 0773 832078

ASHFORD
Ashford Computer Centre
2 Station Parade, Clarendon Rd,
Ashford, Middlesex.
Tel: 07842 44955

BASILDON
Godfrey's
28-32 East Walk, Town Centre,
Basildon, Essex.
Tel: 0268 289379

BASINGSTOKE
Fisher's
2/3 Market Place,
Basingstoke, Hants.
Tel: 0256 22079

BATH
Software Plus
12 York Street, Bath
Tel: 0225 61676

BIRMINGHAM
Sherwoods
Great Western Arcade,
Birmingham 2.
Tel: 021 236 7211

BRADFORD
Photosave
18 Cheapside, Bradford BD1 4JA
West Yorkshire.
Tel: 0274 308598

BRIGHTON
Capricorn
1 Queens Road, Brighton, Sussex.
Tel: 0273 29634

CAMBRIDGE
KP Ltd.,
12a Kings Parade, Cambridge.
Tel: 0223 68087

CANTERBURY
Kent Micro Systems
Conquest House, 17 Palace St.,
Canterbury, Kent
Tel. 0227 50200

CARDIFF
Randall Cox
18-22 High St. Arcade, Cardiff.
Tel: 0222 31960

DERBY
C T Electronics
The Spot, Derby.
Tel: 0332 44760

EDINBURGH
The Silicon Centre
6-7 Antigua St., Edinburgh,
Scotland.
Tel: 031 557 4546

GLASGOW
Victor Morris Ltd.,
340 Argyle St., Glasgow G2.
Tel: 041 221 8958

GUILDFORD
The Model Shop
23 Swan Lane, Guildford,
Surrey GU1 4EQ
Tel: 0483 39115

HARROW
Camera Arts
(Micro Computer Division)
24 St. Ann's Rd., Harrow, Middx.
Tel: 01-427 5469

HATFIELD
Microworld
2 Crawford Road, Hatfield, Herts.
Tel: 82 64137

LEEDS
Bass & Bligh
4 Lower Briggate, Leeds,
W Yorkshire.
Tel: 0532 454451

LEICESTER
Youngs
40-42 Belvoir St., Leicester.
Tel: 0533 544774

LONDON SE9
Square Deal
375 Footscray Road,
New Eltham, London SE9
Tel: 01-859 1516

LONDON N.1
ASP Micro Systems
185 Upper St., Islington.
Tel: 01-359 9095

LONDON W11
Electroleisure
120 Notting Hill Gate.
Tel: 01-221 7029

MACCLESFIELD
Camera & Computer Centre
118 Mill Street, Macclesfield,
Cheshire. Tel: 0625 27468

MANCHESTER
Lomax Ltd.
8 Exchange St., St. Ann's Square,
Manchester A2 7HL
Tel: 061 832 6167
Mr. Micro Ltd.
69 Partington Lane, Swinton,
Tel: 061 7282282
open Thurs.-Fri.-Sat. till 8 p.m.

MIDDLESBROUGH
McKenna & Brown
190 Linthorpe Road, Midbrough.
Tel: 0642 248345

NEWCASTLE-ON-TYNE
Turners
29-31 High Friars, Eldon Square,
Newcastle. Tel: 0632 612901
Newcastle Camera & Computer Mart
16 Northumberland, Court,
Newcastle. Tel: 0632 327461

NOTTINGHAM
Cameo Computers
8/9/10 Trinity Walk, Nottingham.
Tel: 0602 42912

PAIGNTON
Devon Computers,
81 Upper Manor Road.,
Paignton, Devon.
Tel: (0803) 526303

PRESTON
Wilding's
49 Fishergate, Preston, Lancs.
Tel: 0772 556250

READING
David Saunders Computer Centre
8 Yield Hall Plce, Reading, Berks.
Tel: 0734 580719

RUGBY
The Rugby Micro Centre
9-11 Regent Street, Rugby.
Tel: 0788 70522

STAFFORD
Computerama,
59 Forgate St., Stafford, Staffs.
Tel: (0785) 41899

TEDDINGTON
"Andrews"
49 Broad St., Teddington, Middx.
Tel: 01-977 4716

WALLINGTON
Surrey Micro Systems Ltd.
53 Woodcote Road, Wallington,
Surrey.
Tel: 01-647 5636

WATFORD
SRS Microsystems Ltd.
94 The Parade, High Street,
Watford, Herts.
Tel: 0923 26602

WEST BROMWICH
Bell & Jones
39 Queens Sq., West Bromwich.
Tel: 021 553 0820

WIDNES
Computer City
78 Victoria Rd., Widnes, Cheshire.
Tel: 051 420 3333

WIGAN
Wilding Ltd.
11 Mesnes St., Wigan, Lancs.
Tel: 0942 44382

WOKING
Harpers
71-73 Commercial Way, Woking,
Surrey.
Tel: 04862 61061

WORCESTER
David Waring Ltd.
1 Marmion House, High Street,
Worcester.
Tel: 0905 27551

COMPUTER DEALERS!

(or prospective Computer Dealers!)
If you would like to know more about becoming a **SPECTRUM APPOINTED DEALER** on an **exclusive area basis**, please contact **MIKE STERN** or **ALAN WARREN** on **(0727) 66646**
Spectrum (U.K.) Ltd. Unit 6, Marlborough Trading Estate, Lattimore Road, St. Albans, Herts.

MAIL ORDER

When it comes to **MAIL ORDER** our **service is FAST!** with **SECURICOR DELIVERY to anywhere in the British Isles.** – Ask your nearest **SPECTRUM** dealer for further details at time of ordering.

Up to £1000 INSTANT CREDIT with a SPECTRUM CHARGECARD

With a **SPECTRUM CHARGECARD** you choose the credit limit to suit **YOU**, e.g. a **monthly payment of £10** gives you **£200 credit**. Ask your nearest **SPECTRUM COMPUTER CENTRE** for written details on how to apply for **your SPECTRUM CHARGECARD – NOW!**
(Typical APR 30.6%)

V.A.T.

You will see that we quote our prices both **including VAT** and **excluding VAT** – **no hidden 15% to suddenly up-lift your bill** but also making our prices **easier** to compare with our competitors.

Not all stores carry every advertised item, please phone before making a journey — Prices correct at time of going to press E. & O.E.

EVERYTHING SPECTRUM OFFER... PLUS

SHARP

We have in stock the full range listed by Spectrum.

PLUS The MZ 80B and a full range of peripherals.

APPLE

Apple II and III Computer Systems in stock and we are an authorised Service Centre for Apple.

PLUS We are an appointed dealer for Jarman Business Systems.

NASCOM

	EXC VAT	INC VAT
Nascom 2 (kit) No user RAM	£225.00	£258.75
Nascom 2 (built) No user RAM	£285.00	£327.75
Nascom Power Supply (kit)	£35.00	£40.25
Nascom Micro-ed 8K Computer	£399.00	£458.85
Nascom "Special Edition" 8K Computer	£429.95	£494.44
Nascom 3 48K Computer	£499.00	£573.85
Nascom RAM B 16K Board (kit)	£80.00	£92.00
Nascom RAM B 16K Board (built)	£100.00	£115.00
Additional 16K RAM	£15.00	£17.25
Additional 32K RAM	£30.00	£34.50
48K Add-on Memory Board for "Special Edition"	£130.00	£149.50
I/O Board (kit)	£45.00	£51.75
PIO Option	£12.00	£13.80
CTC Option	£14.00	£16.10
UART Option	£16.00	£18.40
Nascom Single Disk Drive inc FDC Card	£470.00	£540.50

STOP PRESS!

Scoop purchase of manufacturers final stock.
NASCOM IMP Printer complete with 'IMPRINT' ROM.
Previously £325 plus VAT.
Now £199.95 exc. VAT.
£229.95 inc. VAT.

THE SYMBOL OF VALUE

SRS MICROSYSTEMS

94 The Parade, High Street, Watford, Herts.
Telephone (0923) 26602.
YOU'LL VALUE OUR EXPERIENCE, YOU'LL VALUE OUR PRICES. FREE SECURICOR DELIVERY OR POST ON ORDERS OVER £50

Keen prices and knowledgeable staff have created a need for bigger and better new premises in Watford. Access & Barclaycard welcome.
Hire purchase and part exchange available. E. & O.E.

NEW LARGER PREMISES

EVER WANTED TO WRITE MACHINE CODE PROGRAMS? NOW YOU CAN —

NEW

M CODER

THE FIRST REAL MACHINE CODE COMPILER FOR THE ZX81

Simply write your program in Basic (or load an existing program), press a key and M CODER will automatically compile it into machine code.

M CODER handles 99.9% of all Basic.

Once used you'll never write Basic programs again —

Give ALL your programs that super-fast professional look with M CODER.

Buy M CODER now and revolutionise your programming for the all inclusive price of only £7.95.

Cheque or postal order to:
PERSONAL SOFTWARE SERVICES
112 Oliver Street, Coventry CV6 5FE

POWERFUL PROGRAMS FROM PSS

SOFTWARE

for ZX-81, ZX Spectrum, BBC Micro

New maths programs – improve your maths and programming skills by playing Simon maths **Games**.
Choose your own level of difficulty – suit ages 10-16.
10 programs on each tape – most incorporate **Moving Graphics** and are fun to run.
Let your computer help you to pass your exams.

Maths 1	Number, Area, Fractions, Decimals, Money, Length, Number, Estimation, Test 1, Game 1.
Maths 2	Volume, Ratio, Percentages, Perimeter, Bases, Time, Number, Estimation, Test 2, Game 2.
Maths 3	Directed Number, Co-ordinates, Angles, Scale, Probability, Density, Temperature, Estimation, Test 3, Game 3.
Maths 4	Square Roots, Indices, Circles, Inequalities, Statistics, Number, Fractions, Angles, Test 4, Game 4.
Maths 5	Equations, Directed Number, Statistics, Probability, Circles, Equations, Pythagoras, Simultaneous Equations, Test 5, Game 5.



Simon Software

Quality tapes copied at normal speed for better reproduction.
Cassettes with
Printed Programs £5(inc.VAT). Please add £1 p&p.
FREE! blank tape with each **set** ordered.
Send cheque/PO to: Simon Software, Dept. E.S. Freepost, New End, Redditch, Worcestershire.
(Please state ZX-81(1K), (16K) or BBC Micro) or **ZX Spectrum.**

BBC ▼ nascom
SPECTRUM
adventure

Colossal Adventure: The classic mainframe game "Adventure" with all of the original treasures and creatures plus 70 extra rooms!

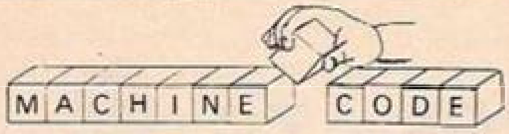
Adventure Quest: From the Great Forest; up Orc Mountain; through caves, desert, swamp, fire, lake and bleak moorland on an epic quest to defeat Tyranny.

Dungeon Adventure: NEW! The dungeons of the Demon Lord have survived His fall. Can you acquire their treasures first?

Each Level 9 adventure is packed with puzzles and has over 200 individually described locations - a game could take weeks to complete! Only data and code compaction allow us to provide so much.

Each adventure requires 32K of memory & costs £9.90 (including VAT and P&P).

Send order, describing your computer, or a SAE for full details to:
LEVEL 9 COMPUTING
229 Hughenden Road, High Wycombe, Bucks



ZX Spectrum — ZX81

In 1981, ACS Software published ACSEMBLER and DIS-ACSEM. These are now generally regarded as quite simply the best assembler and disassembler programs available for the ZX81.

"The disassembler . . . is really fantastic." A.M., London
"I am very pleased with the assembler and I feel that you have a real winner in this program." R.B., Gloucester
Your programs are first class. Looking forward to more." A.J., Norway.
". . . the single biggest step to proficiency in machine code programming." SINCLAIR USER

Now, with the superior facilities of the ZX Spectrum, ACS Software have done it again. **Ultraviolet** and **Infrared** are assembler and disassembler programs that will extend your Spectrum. Look at the facilities that Ultraviolet offers:

Works entirely in decimal (no hex problems); all Z80 instructions correctly assembled; supports the pseudo-instructions EQU, ORG (multiple ORGs allowed), DEFB, DEFW and DEFS; code can be assembled at one location and then relocated; allows alphanumeric labels of any length; full listings of assembled code and mnemonics can be output to the printer; full error trapping with faulty instruction clearly indicated; comments can be included in the source file.

So now there is no need to be intimidated by machine code - with Ultraviolet and Infrared it's child's play! Buy them from the machine code specialists - ACS Software.

ULTRAVIOLET - £7.50 **INFRARED - £6.75**

The following programming aids are available for the 16K ZX81 at £5.50 each. SAE for details. Prices include postage and packing for UK orders, overseas clients please add appropriate postage.

ACSEMBLER: DIS-ACSEM: ACS DEBUG: PROGSTORE: TOOLKIT: PROGMERGE (version 2): TAPEKIT
PROGMERGE and TAPEKIT won't make a Spectrum out of your ZX81 but they will give it some interesting new facilities!

ACS SOFTWARE 7, Lidgett Crescent,
Roundhay,
Leeds LS8 1HN

BRITAIN'S LARGEST SINGLE MICRO USER GROUP

BEEBUG FOR THE BBC MICRO

INDEPENDENT NATIONAL USER GROUP FOR THE BBC MICRO

IF YOU OWN A BBC MACHINE, OR HAVE ORDERED ONE, OR ARE JUST THINKING ABOUT GETTING ONE, THEN YOU NEED BEEBUG. BEEBUG runs a regular magazine devoted exclusively to the BBC Micro (10 issues per year). Now 36 pages.

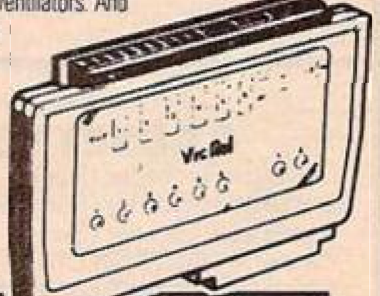
Latest news on the BBC project.
What you should know before you order a machine.
Members' discount scheme on books and hardware.
New program listings, regular advice clinic, and hints and tips pages in each issue.
April Issue: 3D Noughts and Crosses, Moon Lander, Ellipse and 3D Surface. Plus articles on Upgrading to Model B, Making Sounds, and Operating System Calls.
May Issue: Careers, Bomber, Chords, Spiral and more.
Plus articles on Graphics, Writing Games Programs, and Using the Assembler.
June Issue: Mazetrap, Mini Word Processor, Polygon; plus articles on Upgrading, The User Port, TV set and Monitor Review, Graphics Part II, More Assembler Hints, Structuring in BBC Basic, plus BBC Bugs.
July issue (36 pages) Invaders and patchwork programs. Fix for BBC cassette Bugs, Mode 7 explored, User define Keys, Software reviews, High res graphics printout, RS423 receive fix.

Membership
6 months £4.90
1 year £8.90
Send £1.00 and A4 SAE for sample
(Overseas add £1.00 for 6 mths. £1.50 for 1 year)

Make cheques to BEEBUG
and send to
BEEBUG, Dept 4,
374 Wandsworth Rd.,
London, SW8 4TE.

FOUR NEW VIC ADD-ONS FROM ADDA

1. **Light up with VicRel.** VicRel is a control relay that plugs straight into the Vic user port to give simple, programmable switching of electrical apparatus in the home, office or factory. Its six relay outputs can control door locks, lamps, valves, tools, ventilators. And two inputs allow the Vic to read signals from external sources such as thermostats, push buttons or light activated switches. VicRel eliminates black boxes full of wires and represents one of the most exciting, value-for-money, firmware additions to any Vic computer system.

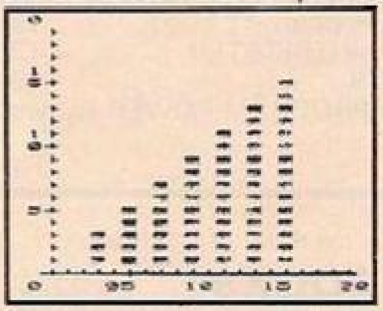


£28.95 INC VAT

2. **Plot away with VicGraf.** This cartridge allows you to explore the complicated equations and functions of graphs. The menu screen, activated by the Vic's special function keys, will automatically plot a graph, define new functions, calculate accurate values of an intersection, find the maxima and minima of a function. Simple editing allows you to check current functions and to change them. A necessary and attractive addition to any educational situation where graphs need to be explored.

£28.95 INC VAT

3. **Crunch & Display with VicStat.** A plug in cartridge that undertakes statistical calculations—such as Meanvalues, Standard deviations and Variances—and displays using single commands. Other one word commands allow you to draw vertical and horizontal bar charts,



to plot graphs, and to specify the scales and the colours used by these commands. It will also sort numeric and character strings. Finally, all or part of screen displays can be copied to the Vic Printer.

VicStat comes complete with a detailed operating guide.

£28.95 INC VAT

FORTH The VicForth plug-in cartridge, complete with 3K of additional memory, takes programming into new dimensions. As both an operating system and program development aid VicForth can speed up program writing and speed of operation.
VicForth is based on fig-Forth and is almost identical to Pet Forth. It does however support the Vic cassette deck—an unusual feature. For those who do much programming a Vic Disk unit is suggested. VicForth provides several hundred one-word commands—listed in the detailed user guide—that can be added to.

£38.95 INC VAT

ADDA COMPUTERS
Contact your local dealer for these VIC products from Adda.
adda
In case of difficulty—or to see demonstrations—call the VIC Centre 154 Victoria Road, London W3. 01-992 9904.

ARCADE QUALITY SOFTWARE FROM LLAMASOFT!!

Spectrum ATARI 400/ 800 VIC-20 ZX81

by Jeff Minter

SPECTRUM

GRAPHICS/CHARACTER CREATOR
Now you can define your very own custom character sets. Or edit the existing sets. Results fully displayed on screen in mode 0, 1 and 2. Many exciting features including: Save, Screen Modes, Reflect, Invert etc.
Supplied on cassette with data £8.00 + 50p p&p.

SPECTRUM SUPERDEFLEX
The idea of this new game is to bounce 'SID' the space invader around the screen into the power pads. Keeping away, of course, from the devil which chases you around the screen. Steer with your deflex shields, but beware the mines or you may be buried alive. Superb graphics and fantastic sound on the 48K SPECTRUM only. £4.95 on cassette.

CITY BOMBER
A full feature version of the popular game 'BLITZKRIEG' supplied for the 16K or 48K SPECTRUM only. £2.95.

ROX III
Blast the falling meteors as they invade your planet. Cruise missiles are your only defence in this world of disaster. If they break through the crust of your planet then your life support systems will fail. A very addictive game with fast action and great graphics. Only £2.95.

GRAPHICS CREATOR
NOT just another character editor! This one allows you to define not only the 21 user definable characters, but also allows you to change the entire 96 character ASC11 set. Creates BYTES files ready for you to load into your own programs. Includes advanced Reflect, Invert, Field commands etc.
Complete with full documentation. If you are at all serious about SPECTRUM graphics, then bin the BIN statement and use Graphics Creator with its easy on-screen cursor editing. £2.99

PLEASE ADD 50p P&P WITH ALL ORDERS



WANTED!
GOOD QUALITY SOFTWARE.
SEND DEMO FOR QUICK REPLY.

TRADE ENQUIRIES WELCOME
Send Cheque/P.O. with order to:
LLAMASOFT SOFTWARE
Dept YC11, 49 Mount Pleasant, Tadley, Basingstoke, Hants. (07356) 4478.

ZX81

CENTIPEDE
The ORIGINAL game from the ORIGINAL author. This is the identical program to that being sold by other companies for three times our price. The game has received ecstatic reviews in the computing press. Program has 30 speed levels and ever increasing Centipede hordes. Tables top 10 scores and their names. Why Wait to Pay More? Only £1.99.

VIC 20

BREAKOUT/DEFLEX
Unexpanded package a full feature version of the popular arcade Breakout plus a new concept in computer games, Deflex!! Both programs on one cassette only £3.95.

BLITZKRIEG (3.5k)
Fly your Vulcan bomber over enemy territory and destroy the city. 25 levels of play. Hi-res colour graphics on the unexpanded Vic 20. Only £4.95.

DEFENDA! m/c
Full feature version of the popular arcade game including; Swarmers, Baiters, Pods, Landers and Humanoids. Controls: Up, Down, Thrust, Reverse, Fire and Smart Bomb. High resolution colour graphics. Joysticks controls. 8k or 16k expansion needed. Only £8.00 + 50p p&p.

TRAXX! m/c
Vic 20 version of the brand new arcade game "Amidar" A Packman/Quix crossbreed. All machine code, fast and fun. Joystick controls. Hi-res colour graphics. 8k or 16k expansion needed. Only £8.00 + 50p p&p.

RATMAN! m/c
Kill the squeaking rats which fall from the sky before they dig in and prey on you! Game includes rats, hammers, men, mutants and spears. M/c, hi-res colour graphics. 8k or 16k expansion needed. Fast and fun for only £5 + 50p p&p.

UTILITY PROGRAMS (for unexpanded Vic 20)
GAME GRAPHICS EDITOR. Create your very own custom characters. Full featutres include Reflect, Save on Tape etc.
SOFTKEY 24.24 key words inc. Peek, Poke, List, Save on your function keys. Both programs supplied on one cassette. Only £6.00.
Coming Soon, plug-in games cartridges at under £20 — please ring for details.

ATARI 400/ 800

TURBOFLEX
Superb ultra-fast and totally new ball game unlike any you have seen before. Uses ATARI's unique features to the full. Incorporates superb colour/sound effects and uses Player/Missile graphics. Tables top 10 scores along with Scorer's name. £6.00 + 50p p&p.

FREE! TO VIC, ATARI & SPECTRUM OWNERS. SEND SAE NOW FOR FREE PROGRAM AND CATALOGUE OF SOFTWARE

HE SAID YOU COULDN'T DO IT WE DID IT!

Revolution in Teaching Program Technics
Appreciate the Real Value of Your Computer

Read ZX81 Horison (with tape)

Learn to Link Copy Move & Merge
No Programmer Should be without This Book

CONTENTS:
Detective,
Billards,
Machine Code Programmer,
Call Back ROutine,
Fill Text,
Animated Cylist,
Load & Save,
We can accept no responsibility for any illegal use of these programs.

From:

NAME ____________________

____

ADDRESS ____________________

____

To:

Uitgeverij Wolfkamp
Postbus 70254
(1007KG) Amsterdam.
Netherlands.
Tel: Amsterdam 020-278931

Payment must be included with order. Price £12.00 POUNDS
Credit cards are accepted.
Cheques payable to J. McNamara/ZX81


PROGRAM POWER MICRO POWER
Attention all ATOM Owners!!
Announcing the Software
SPECTACULAR
from
PROGRAM POWER
MACHINE CODE MONITOR/ DISASSEMBLER
*SINGLE STEP with REGISTER DISPLAY
*BREAKPOINT handling routines
*Tabulation Memory Dump with 'on-screen' Editing (printer option)
*Memory Display—Hex, ASCII, Screen Code, Decimal & Binary
*SEARCH—Hex or ASCII string
*INTELLIGENT COPY
*COMPARISON of two memory blocks
*DISASSEMBLER (full feature)
*INCREDIBLE PRICE—ONLY £14.50
TWO NEW 4K ROMS
SUPER TOOLBOX
*SUPER-FAST Cassette Operation System with error checking, verify and append routines in addition to original 300/120 baud.
*TOOLKIT functions—AUTO, RENUMBER, HELP, FIND, SPACE, APPEND, MEM, VAR, LVAR, DUMP, ZERO, HEX, IHEX, DELETE.
OTHER FEATURES—Flashing Cursor, 2-key Rollover, Repeat Key, Fast Repeat.
*SUPER LOW PRICE—ONLY £14.50.
PROGRAMMERS TOOLBOX
(PACKED 4K EPROM) £24.50
★1200 BAUD CASSETTE OPERATING SYSTEM
★VISIBLE LOAD & SAVE
★29 additional BASIC & TOOLKIT COMMANDS
PROGRAMMERS TOOLBOX NOW ONLY £17.50
ROM SELECTOR BOARD
Suffering from congestion? Switch between up to 4 ROMS located at Hex A000. Assembled and tested unit with compact professionally produced PCB and good quality components. Fits easily into the Utility Socket (IC 24). The additional ROMS above make having a selector board at only £19.50 even more essential!
MACHINE CODE PROGRAM PRICES ARE TUMBLING!!
YOUR MOVE
SCORE 32990 HIGH SCORE 60090
Chess (12K) Improved graphics, plays black or white, mid game level changes, look ahead up to eight moves, offensive, normal and defensive play. Ten sub-levels, castling, 'En passant' by player. Rejects illegal moves. Take back
ASTROBIRDS (12K) NEW version of this incredible GALAXIAN type game. Fantastic sound effects. Screaming missiles & swooping bird men. NOW DOUBLE SPEED OPTION. £5.95.
ADVENTURE (12K-NOT M/C)
Cowboy Shoot-Out (12K) Full feature, two player, arcade shooting game. Superb graphics and sound £5.95
Stock-Car (12K) HI RES. Two Player contest around any of 16 different race tracks. Steering, acceleration and braking controls. Set the level of difficulty for driver and choose the no. of laps £5.95
WRITTEN ANY PROGRAMS! WE PAY 20% ROYALTIES FOR ATOM, NASCOM & BBC MICRO PROGRAMS
SPACE FIGHTER (12K COLOUR) Super High speed "Defender" game. 5 types of intelligent aliens. Repeating laser cannon, smart bombs, hi-score, rankings, bonus points, 6 skill levels. Exciting sound effects £6.95.
INVADER FORCE (12K) Terrific version of 'Space Invader' 4 types of invaders, mother ship, great sound, hi-score, 6 skill levels £5.95
ATOMSTORE (12K-NOT M/C) Database filing & printing program, excellent value at only £8.95
PLEASE NOTE: WE ARE AUTHORISED DEALERS FOR ACORN ATOM, BBC MICRO & DRAGON 32
WE Guarantee THAT ALL OUR ADVERTISED PROGRAMS HAVE BEEN COMPLETED AND ARE READILY AVAILABLE
Please add 55p order P & P + VAT at 15%
MICRO POWER LTD.
8/8A REGENT STREET, CHAPEL ALLERTON LEEDS LS7 4PE.
Tel. (0532) 683186

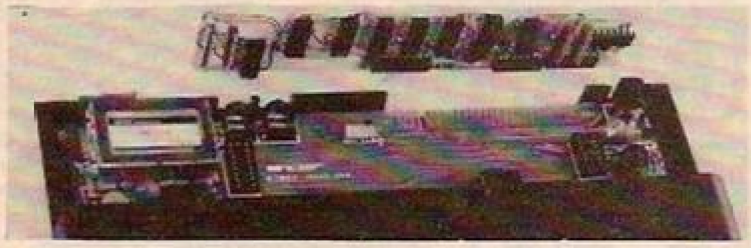
DOWNSWAY

ELECTRONICS (UK) LTD.

MORE MEMORY FOR YOUR ZX81 OR SPECTRUM!

NEW!

32K RAM FOR SPECTRUM



A full 48K of memory for the 16K Spectrum — simple D.I.Y. installation by just undoing 5 screws and plugging in! "State of the art" technology — advanced design using fewer ICs for high performance, reliability and economy.

ONLY £42.50 plus p & p.





MEMORIES FOR THE ZX81

The Downsway 64K Memory* slots directly on to the computer, without needing an additional power supply, or adding any extra load to the internal 5v regulator. Trade in your old 16K RAM Pack (any make, any age, any condition) for £12.50 against a Downsway 64K Memory to bring the price down to only **£47.45** plus p & p. Without trade-in, it costs just **£59.95** plus p & p — still incredible value!

If you only want 16K of memory for your ZX81, the Downsway 16K RAM Pack offers the same benefits of high quality and low price at only **£24.95** plus p & p.

Both memories measure only 2½ x 1½ x 1in. and are supplied with a foam cushion strip to provide added mechanical stability.

* Reviewed in ZX Computing Aug/Sept 1982 and Popular Computing Weekly 22/7/82.

Naturally Downsway add-on memories are fully tested and guaranteed, but should you be dissatisfied for any reason, just return the memory within 14 days for a full refund (and your old 16K RAM pack, where appropriate).

Please allow up to 28 days for delivery.

To: Downsway Electronics (UK) Ltd
Dept. M, Downsway House, Epsom Road, Ashtead, Surrey.

Please send me:

Qty.	Item	Price	Total
	32K RAM for Spectrum	£42.50	
	64K Memory for ZX81 at trade-in price (my old 16K RAM Pack is enclosed)	£47.45	
	64K Memory for ZX81 at normal price without trade-in	£59.95	
	16K RAM Pack for ZX81	£24.95	
Post and Packing			£2.00
Total			£ .

My cheque/P.O./Money Order is enclosed

NAME: ____________________

ADDRESS: ____________________

____________________ YCII

TAURUS COMPUTER DESIGN

Our product range for the ZX81 is as follows:

TAURUS 8K PROMCARD
- Fills memory space 8K-16K
- Housed within ZX81 case—easy installation
- Link selectable: 7K PROM+1K RAM or 8K PROM (2×2732)
- Ideal home for TAURUS SOLID SOFTWARE©

TAURUS 16K RAMPACK
- User switchable : Model A 16K RAM or 14K RAM+2K PROM (2716)
  : Model B 16K RAM or 12K RAM+4K PROM (2732)
- Flexible connection to ZX81—eliminates memory wipeout
- Rugged construction—proven high quality design
- Ideal home for TAURUS SOLID SOFTWARE©

TAURUS MACHINE-CODE MONITOR

Version 1:
- 16 user utility commands
- Optimised for developing and testing machine code
- Available as TAURUS SOLID SOFTWARE© on all TAURUS hardware products
- Also available on cassette

Version 2:
- As Version 1+MACHINE CODE DISASSEMBLER
- Displays address, hex instruction bytes, source code
- Standard X-80® mnemonics
- Relative jumps shown with absolute addresses
- Also available on cassette

GRAPHICS EDITOR
- Make your own character shapes—whatever you want!
- Includes routine for switching character sets
- Two new character sets provided (including lower case)
- Available as TAURUS SOLID SOFTWARE©

MACHINE-CODE ASSEMBLER
- Standard Z-80® mnemonics
- Optimised for ZX81 keyboard layout
- Up to 256 user-definable labels
- Available as TAURUS SOLID SOFTWARE©
- Also available on cassette

PRODUCT SUMMARY

	16K RAMPACK		8K PROMCARD	Cassette
	Model A	Model B		
(Hardware only)	£38.00	£38.00	£25	—
MONITOR Version 1	£45.00	—	£8 per EPROM	£7.50
MONITOR Version 2	—	£49.00	£9 per EPROM	£8.50
ASSEMBLER	—	—	£12 per EPROM	£6.50
GRAPHICS EDITOR	—	—	£9 per EPROM	—

Send for details or cheque with order to:
TAURUS COMPUTER DESIGN
47 High Street, Baldock, Hertfordshire SG7 6BG
Telephone Baldock (0462) 893900

SPECTRUM NEWS FROM

EAST LONDON ROBOTICS

Just received your ZX SPECTRUM? No point in looking any further—we have the products you need at the prices you expect.

SP48

32K Memory extension
(giving total of 48K. Upgradeable to SP80)

£25

SP80

64K Memory extension
(giving massive 80K)

£50

Both the SP48 and the SP80 fit inside the Spectrum case, are fully compatible with all Sinclair add-ons (ZX Printer, RS232, Microdrive etc.), are very low in power consumption, require no soldering, are easy to fit and remove and carry our full guarantee.

Transfer your ZX81 BASIC and machine code programs and data onto your Spectrum in minutes with the fabulous new

ZX SLOWLOADER

£10

SOFTWARE PRODUCT OF THE YEAR

This superb piece of software enables your Spectrum to LOAD programs from ZX81 tapes and automatically converts them to "Spectrumese" ready for normal Spectrum SAVEing.

MICRO POWER GIVE A GREAT DEAL MORE

** SPACIOUS SHOWROOM OPEN MON. to SAT.
*FRIENDLY AND HELPFUL STAFF
*EXPERT ASSISTANCE ALWAYS ON HAND
*GOOD RANGE OF COMPUTER BOOKS
*AFTER SALES TECHNICAL BACK-UP and SUPPORT

ACORN ATOM

SPECIAL OFFER (While stocks last)

Built & Tested ATOMS	
Basic (8K Rom + 2K Ram)	£117.50
Expanded (8K Rom + 12K Ram)	£142.50
Disk Packs (inc. FREE Buffer Kit)	£299.00
ATOM CALC ROM	£34.00
WORD PROCESSOR ROM	£26
FLOATING POINT ROM	£20
ROM SELECTOR BOARD	£19.50
BBC BASIC (phone for availability)	
Full Range ACORNSOFT programs	
BOOKS	
Getting Acquainted with your Acorn Atom	** £6.45
39 Tested Programs for the Acorn Atom	£6.45
Atom Magic Book	£5.50

BBC MICRO

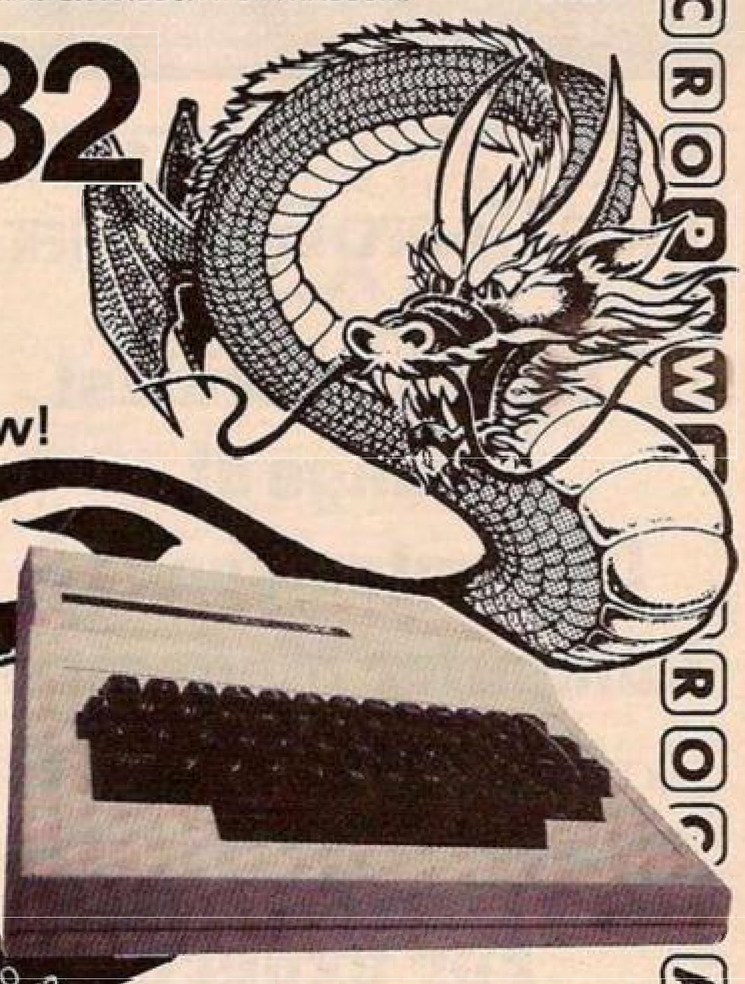
MODEL A	£295
MODEL A (32K)	£323
MODEL B	£378
DISKS & INTERFACES (phone for availability)	
14 Inch Colour Monitor	£259
20 Inch Colour Monitor	£299
BOOKS BBC Micro Revealed	£7.50
Basic Programming on the BBC Micro	£5.95
Let Your BBC Micro teach you to Program	£6.45
NEC '30 Hour BASIC'	£5.50
Practical Programs for the BBC Micro and Acorn Atom	£5.95
ACORNSOFT programs for the BBC MICRO	
PRINTERS	
—EPSON MX80 F/T III	£359
—EPSON MX80 T III	£315
—SEIKOSHA GP 100A	£199
Printer Leads (BBC/ATOM/NASCOM)	£18.50

NEW *FROM MICRO POWER*

DRAGON 32

THE FAMILY COMPUTER TO FIRE YOUR IMAGINATION

Easy to Learn! Easy to Use! Colourful! Graphic! Musical! Well-made and Designed to Grow!



KEY FEATURES

** 32K RAM as Standard, Expandable to 64K
** Display:
9 colours available.
5 different resolutions from 16 x 32 to 256 x 192.
** Extended MICROSOFT Colour Basic as Standard.
Advanced graphics commands—set, line, draw, circle, paint, print using:
Advanced Sound
Full Editing—insert, delete, amend.
** Professional Typewriter Keyboard (Guaranteed for 20 million key depressions).
** FREE 160 page 'BASIC' training manual.
** Simple 'plug-in' Connections for Joysticks, Printer, Games, Cartridges and 'auto-controlled' cassette.
** Software on Cartridge and Cassette already available (send for details).

PRICE ONLY **£199.50** incl. V.A.T.

MAIL ORDER—£7 Carriage but FREE on cash/cheque orders.

FREE DRAW WIN £100 Order a DRAGON from MICRO POWER before 31st DECEMBER 1982, and get FREE ENTRY into our CHRISTMAS DRAW!! FIRST PRIZE £100 cash. TWO PRIZES for RUNNERS UP of a FREE PROGRAM CASSETTE.

THINK DRAGON !!
THINK MICRO POWER!!

Please Add 15% VAT to all items except books. Post & Packing 55p/order. Large Hardware Items £7.00 Carriage

MICRO POWER LTD.
8/8a REGENT STREET,
CHAPEL ALLERTON,
LEEDS LS7 4PE.
Tel: (0532) 683186

PROGRAM POWER MICRO POWER

MIDWICH HAS MOVED!
OUR PRICES HAVE TOO — DOWN!

MEMORIES ** NEW LOWER PRICES **

2114 Low Power 200ns	0.80	4116 200ns	0.70
2708 450ns	2.79	4116 150ns	1.10
2716 450ns (5V)	2.10	4118 150ns	3.38
2716 350ns (5V)	3.59	4164 200ns (TI)	4.65
2716 450ns (3 rail)	5.95	4816/4516 100ns	2.69
2732 450ns	3.75	5516 200ns	9.38
2732 350ns	4.40	6116P3 150ns	3.85
2532 450ns	3.60	6116LP3 150ns	5.75

BBC MICRO UPGRADE KITS ** NEW LOWER PRICES **

As some parts are still in short supply please check availability before ordering.

BBC 1	4516/4816 x 8 100ns	21.50
BBC 2	Printer/User I/O kit (IC69, 70 + PL9, 10)	8.00
BBC 4	Analogue input kit (IC73, 77 + SK6)	6.70
BBC 5	Serial I/O and RGB kit (IC74, 75 + SK3, 4)	11.45
BBC 6	Expansion bus and tube kit (IC71, 72, 76 + PL11, 12)	6.25
BBC 21	Printer cable complete	13.00
BBC 22	Connector for user port with 36" cable	2.00
BBC 44	Analogue input plug with Cover	2.25
BBC 55	5 and 6 pin DIN plugs for Serial I/O and RGB input	0.99
BBC 66	Connector for Bus port with cable	3.50

VISA

24 Hour Telephone order service for credit card holders.
All prices exclude VAT and carriage (0.75 on orders under £10 nett)
Official orders from educational and government establishments and public companies accepted. Credit accounts available to others (subject to status).
All orders despatched on day of receipt. Out of stock items will follow on automatically at our discretion or a refund will be given if requested.
NO SURCHARGE FOR CREDIT CARD ORDERS

MIDWICH COMPUTER CO LTD

Dept YC, Rickinghall House, Rickinghall, Suffolk IP22 1HH
Telephone (0379) DISS 898751

Please make a note of our new address & telephone number

Salamander Software

PRESENTS

Software from the south for the DRAGON and BBC microcomputers.

WIZARD WAR
The mighty mages of the Tri-suns strive for supremacy in a fearsome battle of skill and strategy!

DRAGON RIDER
Can you destroy the enemies from the sky before your fiery steed runs out of puff

STAR TREK
A full version of this classic game, for the Dragon; features Faery Queen, hyperprobe, time travel, tractor beams and more!

VULCAN NOUGHTS AND CROSSES
Pit your wits against the Dragon or your friends in this three-dimensional game of logic!

TANKS!
Variable wind and terrain make this exciting two-player game a challenge for everyone!

GAMES COMPENDIUM
A selection of games for all the family, including Blackjack, Donkey Derby, Kingdom, Noughts & Crosses, Lunar Lander and Hunt the Wumpus!

All games £6.95 inc p&p.

RING NOW TO ORDER DIRECT!

27 Ditchling Rise, Brighton, E. Sussex. BN1 4QL.
Tel: 0273 686454

Discount for bulk orders and retail: send SAE for catalogue.

Lion Micro Computers

London's widest range of Computer Books & Computer Magazines

EXTENSIVE RANGE OF SOFTWARE
ACCESSORIES AND PERIPHERALS

For experts and beginners alike

Lion House, 227 Tottenham Court Road, London W1P 0HX
Telephone: 01-580 7383 & 01-637 1601 Telex: 28394 Lion G.
Open 9 to 6 Mon-Sat
SEND LARGE SAE FOR OUR LISTS

PRO SOFTWARE

BBC MICRO (A&B)

* NEW * SPACE ADVENTURE (Mode 1) Machine Code - Model B only £8
Our best selling game for the Atom now re-written and enhanced for the BBC. Intriguing mixture of Space Invaders, Maze and Adventure.

MIDDLE KINGDOM (Mode 7) Basic & Machine Code. £8
Original real time adventure with over 300 rooms to find and explore. Fight (or avoid!) the many different monsters and retrieve the lost treasures of Hylem. Many different scenarios and characters.

SPACE INVADERS (Mode 5) Machine Code. £8
Fast action, full-feature version of this popular game. Outstanding high resolution colour graphics plus sound.

REVERSI and GOMOKO (Mode 5) Machine Code. £8
Response time under one second for the first 3 levels. Many features, graphic board, problem solving, etc. Both games are very absorbing and challenging.

GAMES TAPE I (Mode 5) Machine Code. £8
Moving Wall Breakout, Snake and Hunt are fast moving addictive games, very colourful. Three quality games for the price of one.

MICRO MAN (Mode 2) Machine Code - Model B only - Fast moving, excellent colour graphics with sound. £8

* NEW * Now available. Word Processor package only £15.95
Written in machine code for speed and versatility. Easy to use with full on-screen editing and justification (more useful and powerful than a text editor), insert, delete, move, copy, variable tab setting, margins plus many more features. Complete with instruction manual. Large SAE for further details.

All programs supplied on quality C-15 cassettes. All prices are inclusive, no extras. Buy any two cassettes and deduct £1 from total. SAE for catalogue.

ATOM software also available. Space Adventure Invaders, Air Strike Only £6 each. SAE for details of our full range.

PRO SOFTWARE BBC

121 TYN-Y-TWR
BAGLAN
PORT TALBOT
WEST GLAMORGAN
SA12 8YE
MAIL ORDER ONLY

FOR YOUR MICRO COMPUTER NEEDS

- MICRO COMPUTERS
- ACCESSORIES
- PERIPHERALS
- EXTENSIVE RANGE OF SOFTWARE
- WIDE RANGE OF BOOKS & MAGAZINES
- IN HOUSE AFTER SALES SERVICE DEPARTMENT

STOCKISTS FOR APPLE, OSBORNE, NEWBRAIN ETC.

Lion Micro Computers

THE SPECIALISTS

Lion House, 227 Tottenham Court Road, London W1P 0HX
Telephone: 01-580 7383 & 01-637 1601
Telex: 28394 Lion G.
Open 9 to 6 Mon-Sat

ELECTRONICS APPLIED,
4, DROMORE ROAD,
CARRICKFERGUS, Co. ANTRIM BT38 7PJ
Please add 55p/order P & P

MAIL ORDER ONLY

5% discount

BBC COMPATIBLE software

MAIL ORDER LIST SEND LARGE S.A.E.

Envelope and Character Definer. (32k)

Together these utility programs offer a complete character and sound envelope defining package for the BBC Micro. Even if you fully understand both the envelope and character defining commands, these programs will make their definition quicker and more accurate.

side 1	*side 2*
ENVELOPE DEFINER	CHARACTER DEFINER
• Excellent use made of graphics windows and colour to display pitch and volume. • Database containing 20 predefined envelopes of everything from phasers to explosions. • Example graphs and step by step prompts allow easy defining of your own sound envelopes.	• 'A very nice VDU23 character definition program' — Computer Users Club (GB). • Shows both magnified and true size characters as they are defined. • All other definable characters can be called up for display. • Easy to use and check performed on all input.

Recorded on quality cassettes, sent by first class post

Introductory Price - £4.95

Dealer Enquiries Welcome

ZX81 SOFTWARE ZX81

SPECIAL OFFERS

PACK 1 GAMES (Save £5.60) **£12.00**
TEST-MATCH + FOOTBALL-LEAGUE + STOCKMARKET + VIDEO-MAP. These are serious games, using the full 16K RAM.

PACK 2 GRAPHICS (Save £7.85) **£12.00**
VIDEO-VIEW + VIDEO-SKETCH + VIDEO-GRAPH
Our high acclaimed series of graphics programs.

PACK 3 BUSINESS (Save £3.90) **£12.00**
VIDEO-AD + VIDEO-PLAN.
Business software which works.

These are all well established and successful programs. Each program is accompanied by a fully comprehensive operating manual and includes a built in demonstration. The reverse of each cassette carries an audio-commentary which supplements the operating manual.

For illustrated catalogue send S.A.E. (9" × 6")

Immediate delivery.

STONE LANE
KINVER
STOURBRIDGE
WEST MIDLANDS
DY7 6EQ
ENGLAND
TEL. KINVER 2462
STD 038 483 2462

VIDEO SOFTWARE LIMITED

Measurement and Control with your

ZX81

and our proven ANALOGUE PORT

Already many in use in industry, education, hospitals, labs., agriculture and the home. Now extremely low cost control operations and even robotics become a reality.
The ANALOGUE PORT plugs directly into your ZX81 and offers

- 8 separate analogue voltage measuring inputs
- 8 switching outputs for relays, LEDs, sound output.
- Amplifier for mV sensitivity on one input channel
- 6 control lines for further expansion
- Stackable connector for RAM pack, printer
- Self contained, no extra power supply etc. required

Thermometers, light sensors, microphones, joysticks . . . in fact anything which produces a varying voltage, resistance or current may be connected directly to your ZX81 via this port. A Comprehensive manual is included which assumes no previous expertise.

only **£29.95** ready built and tested
*** Return of post delivery ***

ZX FREQUENCY ANALYSIS SOFTWARE (Fast Fourier Transform) on cassette and with manual **£15.20**

Make cheques payable to:
UNIVERSITY COMPUTERS
5 ST. BARNABAS ROAD,
CAMBRIDGE CB1 2BU

Delivery return of post on all items (except EPROM prog.). Official, trade, bulk orders accepted. Please add £1 p&p to cost of order.

KAYDE Electronic Systems Ltd

ZX KEYBOARDS FULLY CASED

ZX81 WITH REPEAT KEY

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.

As reviewed by Tim Hartnel
ZX Computing/Interface **£37.95**



NEW

SPECTRUM

This is a highly professional keyboard, taken from our World Famous and well proven 81 keyboard, it has been redesigned to complement your ZX Spectrum.
BUY NOW BEFORE THE RUSH **£37.95**

FULLY CASED ZX81

RAMPACKS

MASSIVE ADD ON MEMORY

NEW Spectrum

MEMORIES YOU CAN RELY ON

64K	**£72.95**
16K	**£29.95**

Up grade your Spectrum now to 48K. Just add our 32K memory extension plug in board to your Spectrum which already has 16K to give you a massive 48K of memory.

£48.95

ZX81 4K GRAPHICS BOARD

The *KAYDE* Graphics Board is probably our best accessory yet. It fits neatly inside your ZX81. It comes complete with a pre-programmed 4K Graphics ROM. This will give nearly 450 extra graphics and with the inverse makes a total of nearly nine hundred.

The *KAYDE* Graphics Board has facilities for either 2K of RAM (for user definable graphics) 4K of ROM or our 4K Tool Kit Chips that will be available shortly. All the graphics are completely software controlled therefore they can be written into your programmes. Here are a few examples:
A full set of space invaders — Puckman — Bullets, Bombs — Tanks — Laser Bases and Alien Ships
NO EXTRA POWER NEEDED £29.95

FLEXIBLE RIBBON CONNECTOR

Stops movement of RAM PACK	**£12.95**
IN/OUT PORT	**£10.95**
MOTHER BOARD	
Complete with 5 volt regulator	**£18.95**

16K GRAPHICS BOARD SOFTWARE

PECKMAN The only true ZX version of the popular arcade game.
SPACE INVADERS The best version available anywhere.
CENTIPEDE "In all I think this is the best presented moving graphic programme I've yet seen" — Phil Garratt, INTERFACE **£5.95 EACH**
Graphic Software can only be used with a Graphics board

All Hardware comes fully built and tested and complete with a 14 day money back option

Qty	Item	Item price £	Total £
	ZX Spectrum Cased Keyboard/s	37.95	
	ZX Spectrum 32K Rampack	48.95	
	ZX81 Cased Keyboard with repeat key	37.95	
	ZX81 64K Rampack	72.95	
	ZX81 16K Rampack	29.95	
	ZX81 4K Graphics Board	29.95	
	ZX81 Flexible Ribbon Connector	12.95	
	ZX81 Mother Board	18.95	
	ZX81 In/out port	18.95	
	ZX81 16K Graphic Software	5.95	
	ZX81 16K Software	5.95	
	Vic 20 Software	7.95	
	Name of Software	+p&p	

*I enclose a cheque/postal order payable to *KAYDE Electronic Systems Ltd.*, for £..........
*Please charge to my Access/Barclaycard/Trustcard account no.
*Please delete/complete as applicable.
Please print.
Signature
Name: Mr/Mrs/Miss
Address
Please allow £1.50 P&P for all Hardware 50p for all software (Dept YC)

16K 81 SOFTWARE

CENTIPEDE "In all, I think this is the best presented moving graphic programme I've yet seen" Phil Garratt — Interface.
3D/3D LABYRINTH A cubit maze that has corridors which may go left, right, up and down. **£5.95**

4K Tool Kit full of utilities to aid the programmer in constructing and de-bugging E. PROM version for use with graphics ROM. **£9.95**

VIC-20 SOFTWARE NEW

THE KAYDE VALLEY
The ultimate in adventure games

Othello
Plus many more.
£7.95

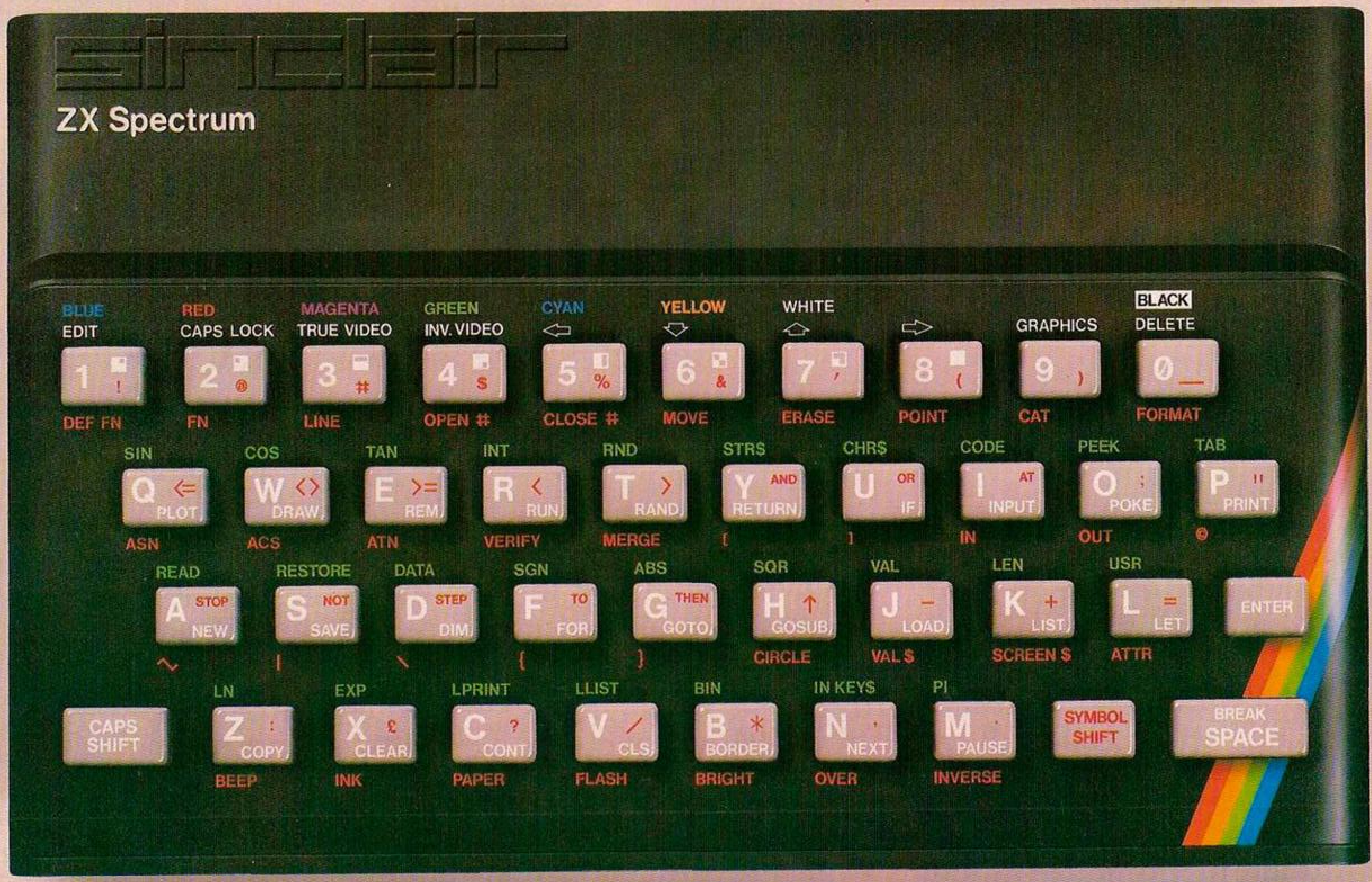
VIC 20 dealer

SEND FOR A FREE CATALOGUE STATING TYPE OF COMPUTER.

WHY WAIT TO PAY MORE
FAST IMMEDIATE DELIVERY

Post To **KAYDE ELECTRONIC SYSTEMS LTD**
Dept **THE CONGE, GREAT YARMOUTH**
NORFOLK NR30 1PJ
Tel: 0493 57867 (Dept YC)
Telex 957247 CHATCOM G

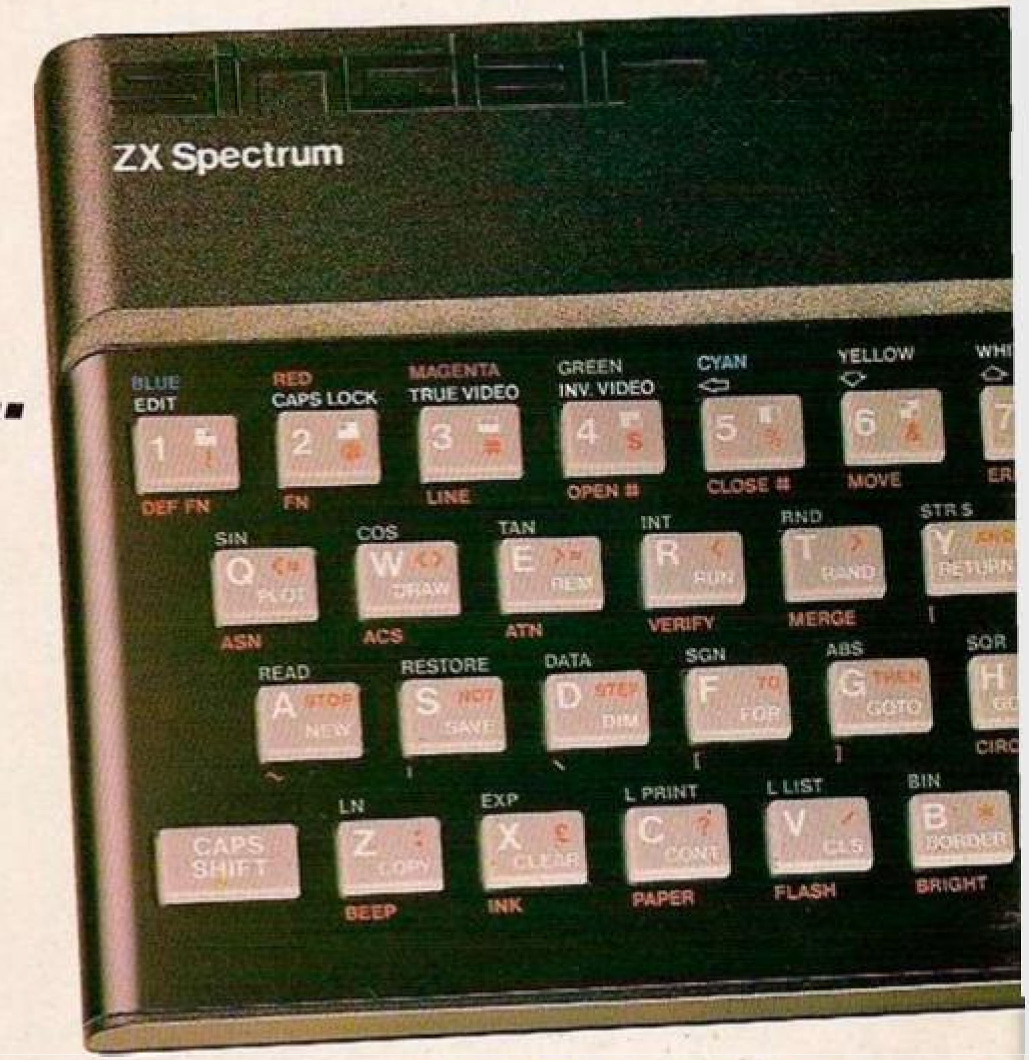
Don't forget you can always order on the telephone with your credit card *Dealers welcome*


sinclair
ZX Spectrum
BLUE EDIT 1 ! DEF FN
RED CAPS LOCK 2 @ FN
MAGENTA TRUE VIDEO 3 # LINE
GREEN INV. VIDEO 4 $ OPEN #
CYAN 5 % CLOSE #
YELLOW 6 & MOVE
WHITE 7 ' ERASE
8 (POINT
GRAPHICS 9) CAT
BLACK DELETE 0 _ FORMAT
SIN Q <= PLOT ASN
COS W <> DRAW ACS
TAN E >= REM ATN
INT R < RUN VERIFY
RND T > RAND MERGE
STR$ Y AND RETURN [
CHR$ U OR IF]
CODE I AT INPUT IN
PEEK O ; POKE OUT
TAB P " PRINT ©
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H ↑ GOSUB CIRCLE
VAL J - LOAD VAL $
LEN K + LIST SCREEN $
USR L = LET ATTR
ENTER
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
LPRINT C ? CONT PAPER
LLIST V / CLS FLASH
BIN B * BORDER BRIGHT
IN KEY$ N , NEXT OVER
PI M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spect

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

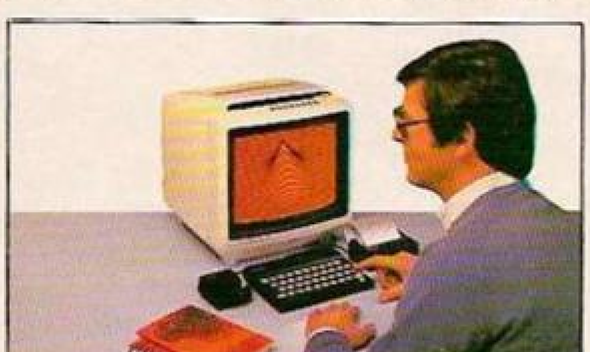
You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

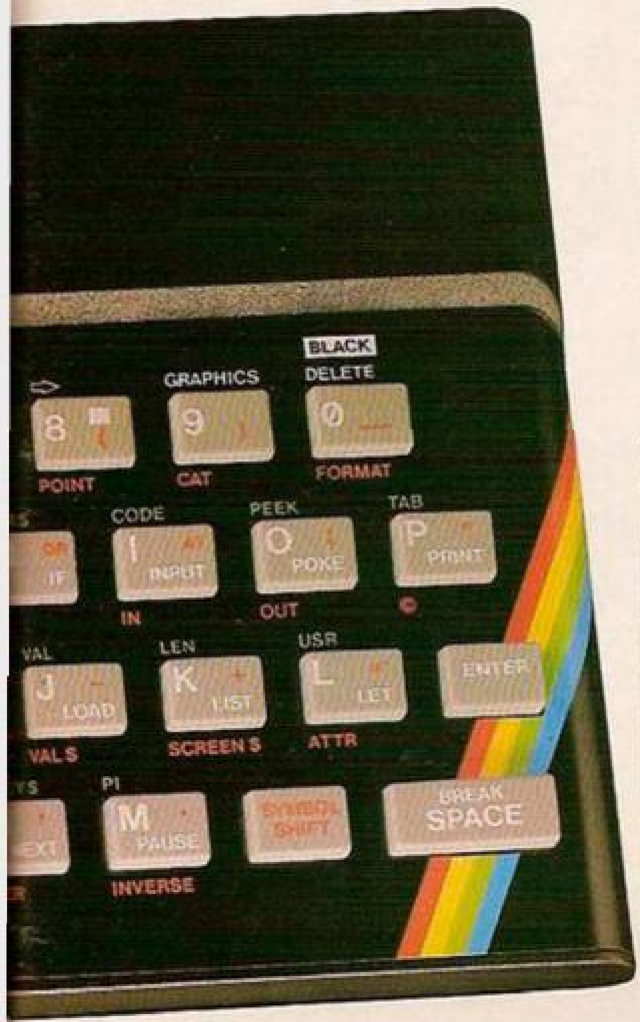
There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only by mail order and only from

sinclair

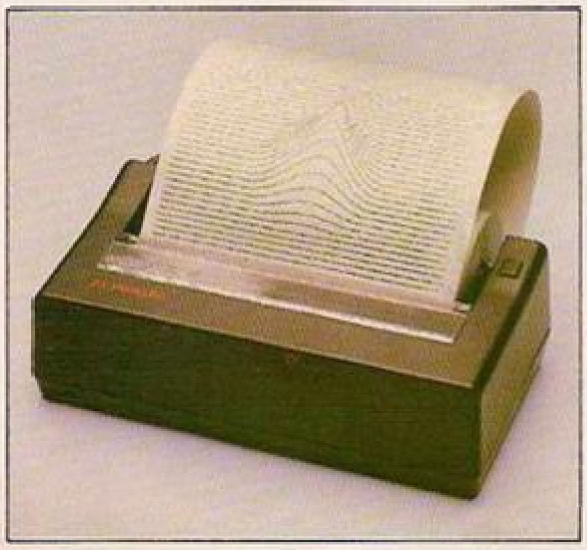
Sinclair Research Ltd,
Stanhope Road, Camberley, Surrey, GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

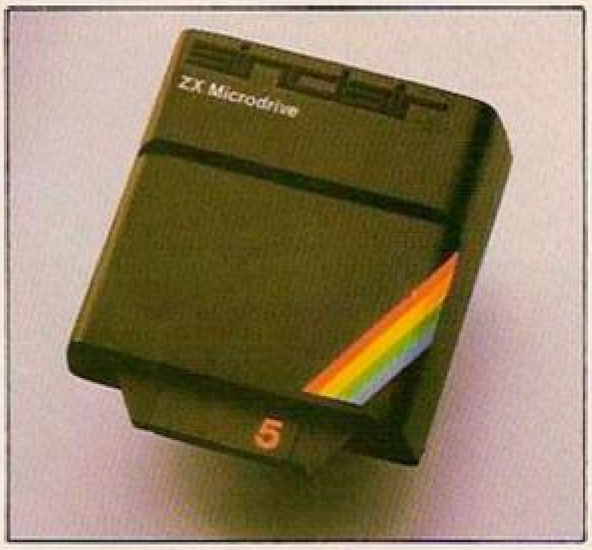
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ ______

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

YOC811

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

ZX Spectrum software: how good and how soon?

The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.



The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.



This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock-control and payroll) and general business management systems (eg matrix models).



This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough: advanced technology makes the ZX Spectrum a breakthrough in price and performance.

Elegant, effective, unique—the ZX Spectrum design.

'Less than half the price of its nearest competitor – and more powerful.'

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant. What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

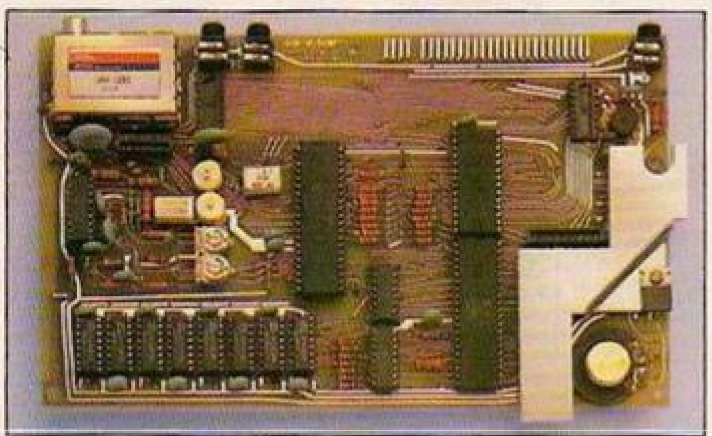
'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

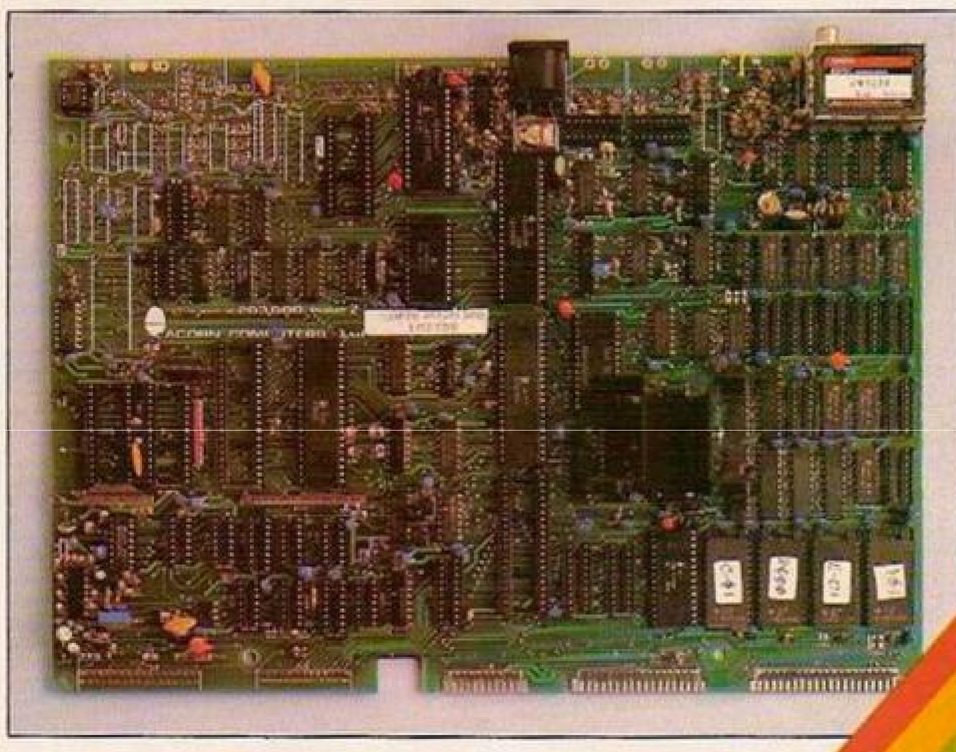
'It has data transfer rate 25% faster, supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

'We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!'

– Clive Sinclair.





Above left: internal layout of Sinclair ZX Spectrum.

Right: Internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.

sinclair ZX Spectrum

Don't miss some fantastic Christmas bargains!



Meet some of the best brains in Britain

at THE

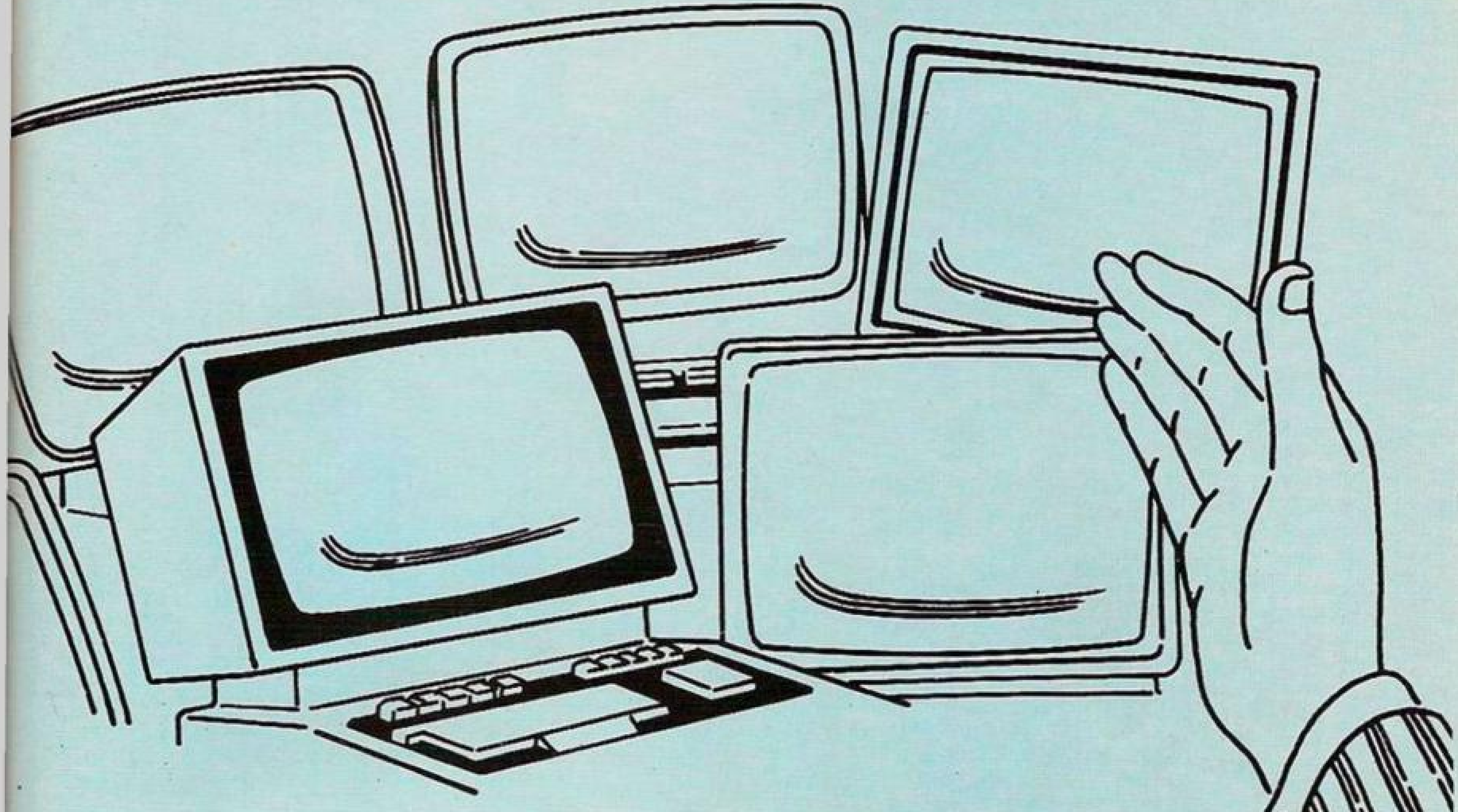
Northern Computer Fair

Personal computers
Home computing
Small business systems

BELLE VUE, MANCHESTER
NOVEMBER 25-27, 1982

Opening Times 10am-6pm each day

SPONSORED BY YOUR COMPUTER AND PRACTICAL COMPUTING



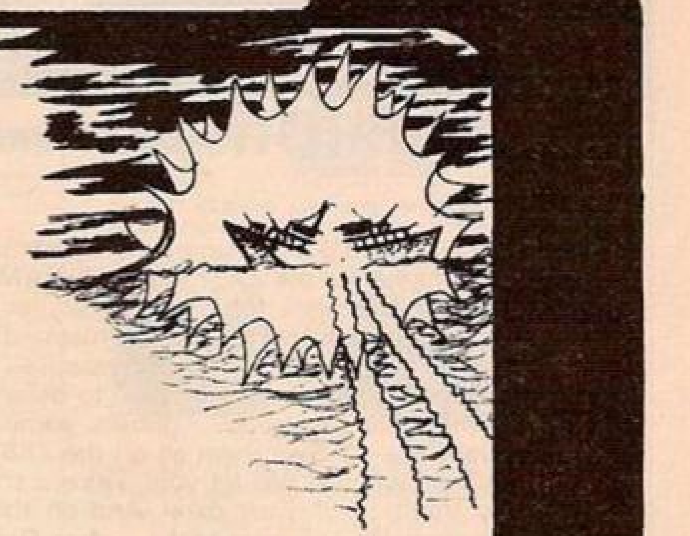
The brains we're talking about are the printed circuit, silicon-chip variety and you'll find them (thinking hard) in the vast range of exhibits at The Northern Computer Fair. The show covers the fields of personal computing, home computing, small business systems and associated software, through computer books to video games, with a special attraction being the ZX 81 Sinclair Village. So whether you're a businessman (or woman) who needs to keep up to date with the latest developments in this fascinating field, a die-hard computer enthusiast, or simply interested in the subject, you'll find what you're looking for at the Northern Computer Fair.

Ticket prices at the door are £2.00 for adults and £1.00 for children under 16, but special party rates are available for 20 people or more with the organiser admitted free. For more information contact IPC Exhibitions, Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ. Tel: 01-643 8040.

HALF PRICE ADMISSION VOUCHERS for readers of YOUR COMPUTER

THE Northern Computer Fair — Personal computers, Home computing, Small business systems adult £1.00 *Cut this coupon and exchange for half-price ticket at the door.* YC11	THE Northern Computer Fair — Personal computers, Home computing, Small business systems child 50p *Cut this coupon and exchange for half-price ticket at the door.* YC11

ATOM — BBC — DRAGON 32



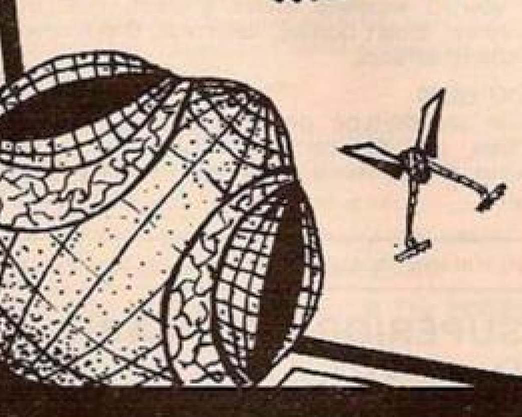
TWO NEW ARCADE GAMES FOR THE ATOM

PAINTER
A superb version of the popular arcade game. Fill in the squares by guiding your animated man around the grid. Beware the "meanies" as they try to knock you off the girders.
12K RAM Priced at only **£6.90**

TORPEDO RUN
Another fantastic high resolution (clear 4) real time game for the "Atom". Can you complete your mission and destroy the enemy convoy? Will you return to a heroes' welcome or is Davy Jones' Locker your final resting place!!!
5K Text
6K Graphics **Price £5.75**

ATOM HARDWARE UTILIKIT
FOR JUST £18.40 ADD 22 BASIC COMMANDS AND FIVE FEATURES!! TO YOUR ATOM
(SUPPLIED FULLY DOCUMENTED ON 4K EPROM)
COMMANDS Read; Restore; Data; Tone; Key X; Clr; Disassemble; On Error; On Escape; Var; Hex; At; List (controlled list with up & down scroll facility); Renumber; Find; Search & Replace; Auto; Delete; Block Move; Cold; Warm; Fast; Slow.
***1200 BAUD CASSETTE OPERATING SYSTEM ADDITIONAL FEATURES**
Visible Load/Save; Audio indication of successful Load/ Save; Extended Lines (ie up to 208 characters per line); Auto Repeat on all keys (except Break & Lock); Auto list of line when an error occurs.

ON AN EPROM BOARD
If you already have an Eprom fitted we supply 4 way and 6 way add on Eprom board, controlled by software.
Prices 4 × £20.70
6 × £26.45



SPACE PANIC
This is the most brilliant reproduction of an arcade game ever seen on the Atom. It's addictive, it's fast, it's a game the whole family will enjoy. Clear the building of monsters by digging holes in the floors to knock them through. Try it! You too will be hooked by it.
12K RAM Priced at only **£6.90**

"ZODIAC" ATOM ADVENTURE WIN £100
Following the success of our 1st Adventure Competition (winner shown below), we have launched our second Adventure Competition (we have doubled the prize money as well). "Zodiac" is your greatest challenge yet from A&F. Solve the problem of this Astrological Adventure and you could win £100. Closing date 30 Nov 82. Full machine code program requires 12K RAM.
Price £6.90



MICRO-LINK

A & F's SHOWROOM & OFFICES NOW OPEN

DRAGON 32 DEALERS

WE HAVE A WIDE RANGE OF SOFTWARE AVAILABLE FOR MOST POPULAR MICROS. CALL IN AND SEE

830 HYDE ROAD, MANCHESTER M18 7JD
TEL: (061) 223 6206

ADVENTURE COMPETITION 1
Answers 1. A.F.S. Enterprize
2. Operation of Transfer Cabinet
3. B.J.Q.L.
Number of correct answers: 6
Winner: Mr John Popplewell, Didsbury M2D DEA.
Judged by: *Your Computer* Magazine and Mr M Fitzgerald, Director A & F Software.

OTHER ATOM GAMES (ALL 12K RAM)

Death Satellite	£6.90
Cylon Attack	£6.90
Minefield	£5.75
Missile Command	£6.90
Polaris	£4.75
Pontoon	£4.75
Escape	£5.75

NEW BBC MOD 'B'

FROGGER
This is as good as any other software "Arcade" game written for the BBC Model 'B'. If you have played it in the arcades save your money — after 35 games you will have paid for this superb reproduction of Frogger.
BBC Model 'B' Price only **£6.90**

OTHER BBC TITLES

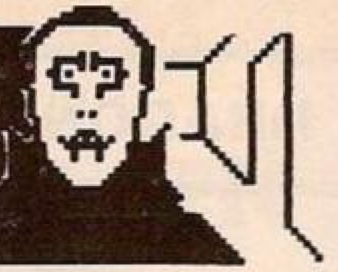
Early Warning — BBC Model 'B'	£6.90
Lunar Lander — BBC Model 'B'	£6.90
Road Runner — BBC Model 'B'	£6.90
Tower of Alos — BBC Model 'A'	£6.90

ALL ORDERS TO:
A & F SOFTWARE
830 HYDE ROAD
MANCHESTER
M18 7JD
24 hr Accesss/Barclaycard service (061) 223 6206. All our products are guaranteed for 12 months and are in stock now. All prices include VAT, Post & Package. Overseas clients please add 10% P&P.

AF

ZX81 & 16K

THE TOMB OF DRACULA!



3D HORROR ADVENTURE GAME!

Occupying over 13½K of memory, a superb 3D graphics adventure game for the ZX81 with 16K RAM, **for only £3.95! Enter** Dracula's tomb at 30 minutes to sunset ... **wander** through the tomb's pre-mapped 300 vaults in search of the fabled Vampire's Treasure ... **pick up** valuable silver stakes and use them to defend yourself against the lurking horrors ... ghouls, zombies, pits of primaeval slime ... **See** them all on the ZX81's plan of the tomb ... when it will let you! **Take** a chance on a Mystery Vault ... if your dare! And all the time the minutes are ticking by to sunset ... when **Dracula** rises from his coffin and comes after **you**! Each of the infinite levels of the tomb has its own 300 vaults ... go as deep as you like, the Prince of Darkness will seek you out in his blood-lust! **WARNING:** people of an exceptionally nervous disposition should play this game only during the hours of daylight! Special facility enables a game in progress to be saved on tape so you can continue it whenever you choose.

Price of only **£3.95** includes ready-to-load cassette with library case and inlay, full instructions, postage and packing. Order today! Money refunded if not delighted! Send cash, P.O. or cheque to:

MOVIEDROME VIDEO (DEPT. YC6)
19 Leighton Avenue, Pinner, HA5 3BW.

SNAKE...HITCH-HIKER...REVERSI... ...CUBE.....ASTEROIDS....LOGO II MEMORY KITS...CHESS...DISASSEM ... .HI



'Hitch-Hiker' is a great adventure game based on characters from the book 'Hitch-Hikers Guide to the Galaxy'. A fascinating game to test your skill and wits whilst trying to collect five objects scattered around the Universe located in such places as the 'Restaurant at the end of the Universe', 'Arthur Dents House' and Belteguese Spacedrome'. Directions can be found in the clues. An intriguing game that can create hours of fun. £5.80+VAT

in our opinion the best B.B.C. software in town!

COMPUTER CONCEPTS

Buy it with Access
BARCLAYCARD VISA

16 Wayside, Chipperfield, Herts, WD4 9JJ. tel (09277) 69727

Send an S.A.E. to get the latest details of our software.

TRANSFORM LTD.

ZX Business Software.

FOR SMALL BUSINESSES AND THE SELF EMPLOYED

Business Bank Account: this program enables you to make debits under 11 subheadings. Statements include totals of all subheadings. £8.75

Sales Day Book: for all your invoices, this program will enable you to prepare statements of outstanding invoices. Program will also calculate VAT. £8.75

Purchase Day Book: keeps a complete record of all your purchases under 11 subheadings. The program will also calculate and deduct VAT. £8.75

Quarterly Analysis: quarterly totals from Bank Account, Purchase and Sales programs can be analysed with this program. £4.75

All the programs have full search facilities and will enable you to prepare quarterly accounts for your VAT returns and annual accounts for your accountant. These programs can also be used by companies not reg. for VAT.

Business Pack: incl. Bank Account, Sales and Purchase programs. £25

Please specify memory size when ordering for your ZX81.

All prices include VAT, Post & Packaging. For details send S.A.E. to:

TRANSFORM LTD.,
41 Keats Ho., Porchester Mead, Beckenham, Kent.
Tel: 01-658 1661

NEW!

QUALITY SOFTWARE FOR THE BBC MICRO

GALAXIANS (32K) £6.50
Fast action version of the popular arcade game. 4 types of Galaxians (in 3 initial screen formations) swoop down individually or in groups of two or three. 6 skill levels, hi-score, rankings, bonus laser bases, increasing difficulty, superb graphics and sound effects.

INVADERS (32K) £6.50
Superb version of the old classic arcade game with a few extras. 48 marching invaders drop bombs that explode and blow away your defences and 2 types of spaceship flyover dropping large bombs which penetrate through your defences. 6 levels of play, hi-score, rankings, bonus laser bases, increasing difficulty, superb graphics and sound effects.

SPACE FIGHTER (32K) £6.50
Arcade-style game based upon features from DEFENDER and SCRAMBLE. 5 types of menacing aliens fire at you and may attempt to ram you in separate attack phases. Fuel dumps, repeating laser cannon, smart bombs, asteroids, 6 skill levels, hi-score, rankings, sound effects.

CENTIPEDE (32K) £6.50
Another incredible arcade-type game, featuring mushrooms, snails, spiders, flies, and the centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, increasing difficulty.

WE PAY 25% ROYALTIES FOR HIGH QUALITY PROGRAMS Add 50p per order for P&P.

SUPERIOR SOFTWARE,
Dept. YC1,
69 Leeds Road,
Bramhope, Leeds.
Tel: 0532 842714

SPECIAL OFFER! Deduct £1 per cassette when ordering 2 or more programs!

MICHAEL ORWIN'S ZX81 CASSETTES

The best software (by various authors) at low prices.

QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun."
from the ZX Software review in Your Computer, May '82 issue.

"I had your Invaders/React cassette ... I was delighted with this first cassette."
P. Rubython, London NW10

"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month."
E. H., London SW4

"I previously bought your Cassette One and consider it to be good value for money!"
Richard Ross-Langley
Managing Director
Mine of Information Ltd.

CASSETTE 1

(eleven 1K programs)

machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat.

Basic:
I Ching, Mastermind, Robots, Basic Hangman. PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16K.
Cassette One costs £3.80.

CASSETTE 2

Ten games in Basic for 16K ZX81

Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
Cassette Two costs £5.

CASSETTE 3

8 programs for 16K ZX81

STARSHIP TROJAN



Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photon torpedo tracking.
PRINCESS OF KRAAL An adventure game.
BATTLE Strategy game for 1 to 4 players.
KALABRIASZ World's silliest card game, full of pointless complicated rules.
CUBE Rubik Cube simulator, with lots of functions including 'Backstep'
SECRET MESSAGES This message coding program is very txlp qexi jf.
MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.
Cassette 3 costs £5.

CASSETTE 4

8 games for 16K ZX81

ZX-SCRAMBLE (machine code)



Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)



INVADERS (machine code)



GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft to fight.

SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed)

LIFE (machine code)
A ZX81 version of the well known game.

3D TIC-TAC-ONE (Basic)
Played on a 4×4×4 board, this is a game for the brain. It is very hard to beat the computer at it.

7 of the 8 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman).

Cassette 4 costs £5.

Recorded on quality cassettes, sent by first class post, from:
Michael Orwin, 26 Brownlow Rd. Willesden, London NW10 9QL *(mail order only please)*

ARE YOU A ZX81 USER WHO'S NOT PLAYING GAMES?



£47.50 Including VAT. complete

ECR 81 DATA RECORDER SAVES AND LOADS YOUR PROGRAMS EVERY TIME!

The ECR81 Enhanced Certified Recorder from MONOLITH is a major advancement in cassette recorder technology which minimises the problems associated with standard audio recorders. The unit is a high reliability program store for ZX computers based on a modified, proven cassette mechanism. The two sections of data recording circuitry automatically ensure precise levels are written onto the tape and that optimised signals are received by the computer.

THE ECR81 IS NOT SUITABLE FOR AUDIO REPRODUCTION
NO MANUAL VOLUME OR TONE CONTROL ADJUSTMENT PROVIDED

- Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.
- Mains Operation only.
- Mains & DIN connector leads provided.
- Certification of tape head alignment - height and azimuth.
- Certified tape tension, torque and speed.
- Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

- Please allow up to 28 days delivery.
- The ECR81 is backed by our 14 day money-back option.

MONOLITH
electronic products
Telephone: Crewkerne 0460 74321 Telex: 46306

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

Please supply me with:	Price	Total
............(Qty.) Monolith ECR 81 Enhanced Certified Recorder(s) to be used with my ZX81	£47.50 (Each)	
I also enclose postage & packing per recorder	£2.50	
Prices include VAT	£	

Please print

Name: Mr/Mrs/Miss.

Address

QCP-FORTH!

*FULL FIG-79 STANDARD (NON-DISK)
*FASTER THAN BASIC
*EASIER THAN MACHINE CODE
*SUPPORTS ZX-PRINTER

Forth, for those who are not already converts, is perhaps the closest yet to the ultimate all-purpose computer language. It is designed to be fast, portable and *extremely* flexible. A FORTH program consists, largely, of definitions of new FORTH words, enabling a user to develop a unique, application oriented, vocabulary. It is even possible to alter the syntax to suit your application (or just your style of program!).

*TAPE & DOCUMENTATION . . . £10

GAMES PACKS 1&2

Pack 1 includes: Space Torpedo, Reverse, M/C Life and more.
Pack 2 includes: Robot chase, Nim, Music, Mini Adventure etc.

UTILITIES PACK

Enhance your BASIC Programs with this set of useful machine code routines.

GAMES PACKS . . . £6 each

UTILITY PACK . . . £5

*****COMING SOON*****

PILOT: the educational language

ALL PRICES INCLUDE VAT & P&P
QUALITY STACKABLE CASSETTES

Quasar Computational Paraphernalia

SOFTWARE

11c HERCIES ROAD · UXBRIDGE · MIDDLESEX

SOUND with ZX-81!

MAKE AMAZING SOUND EFFECTS WITH YOUR ZX-81





£25.95 THE ZON X-81

incl p&p & V.A.T.

* The ZON X-81 SOUND UNIT is completely self-contained and especially designed for use with the ZX-81. It just plugs in – no dismantling or soldering.
* No power pack, batteries, leads or other extras.
* Manual Volume Control on panel – ample volume from built-in loudspeaker.
* Standard ZX-81 – 16K Rampack or printer can be plugged into ZON X-81 Sound Unit without affecting normal ZX-81 operation.
* Huge range of possible sounds for games or: Music, Helicopters, Sci-Fi, Space Invaders, Explosions, Gun-shots, Drums, Planes, Lasers, Organs, Bells, Tunes, Chords etc., or whatever you devise!
* Uses 3-channel sound chip giving programme control of pitch, volume of tones and noise, all with envelope control.
* Easily added to existing games or programmes using a few simple "BASIC" lines.

FULL instructions with many examples of how to obtain effects and the programmes, supplied. Fully Guaranteed.

BI-PAK Dept. YC8 P.O. Box 6, 63A High Street, Ware, Herts.

Access & VISA accepted Ring 0920 3182 for immediate despatch.

Campbell Systems

The very best in machine code for SPECTRUM and ZX81

Spectrum 16K GULPMAN game of the xxxMAN variety, with 15 mazes, 4 chasers, laser defence, 9 grades, 9 speeds, demo mode, choice of joysticks control. "An extraordinarily good program" raves Boris Allan for *Popular Computing Weekly.* We think you will agree. £5.95.

Spectrum 48K MASTERFILE business/domestic filing and reporting system. So flexible it is equally usable for your mailing-lists, catalogues, stock control, text extracts . . . applications are endless. Fully user-defined data and report display formats, dynamic variable-length file, records, and data items. Fully menu-driven, with powerful search facilities, sorting, total/average, update, multiple independent files, printing. Yes, we aim to support Microdrive when Uncle delivers. Nearly all the 8K we use is machine code, so you get 32K per file. Comes with example file and 12-page manual. £15.00.

Spectrum SPDE 16K Disassembler and Editor, as used by other ZX professionals, and we used it to develop the above. £5.95.

ZX81 16K GULP II almost identical spec to GULPMAN, £4.75.

ZX81 16K to 64K THE FAST ONE is the predecessor to MASTERFILE and is in use all over the world now. Specification is very similar to MASTERFILE. £12.00.

All programs supplied double-recorded and mailed 1st class by return. Prices include VAT and postage within Europe. SAE for full list.

CAMPBELL SYSTEMS (Dept YC)
15 Rous Road, Buckhurst Hill, Essex IG9 6BL, England

ANIROG Computers

CO-OP CRAWLEY

VIC 20 AUDIO CASSETTE INTERFACE uses earphone and microphone sockets of the recorder - built and tested £10.50 - Motor control via mi- switch £3 extra.

NEW RELEASE FOR VIC 20

SPACE RESCUE - Rescue the survivors stranded on a devastated star base. Blast your way through fast moving debries to land, rescue and return to dock with mother ship. Action packed, solid machine code programme with hi-res graphic and extended screen - £6.

DRACULA - Enter Dracula's Castle before he wakes up. Solve the adventure quickly and drive a stake through his heart. Multi screen - Hi res. graphic adventure game (3K) - £6.

PACK OF SEVEN (VOL 1) - Value for money games package for unexpanded VIC - £6.

PACK OF SEVEN (VOL 2) - Games for expanded (3K) VIC - £6.

SCRAMBLE (3K) - Full machine code programme. Seven versions to complete with increasing difficulty. Hi res graphics - £6.

We have probably the largest selection of software for:

VIC 20 - SPECTRUM - BBC MICRO - DRAGON 32

Authorised dealers for Commodore - Bug Byte - Audiogenic - Uawa soft - Rabbit - Adda - Ask - Romic - Computer Room - Silversoft - Softec - GKC and many many others.

See this huge collection of software and **VIC 20 - COMMODORE 64** - and **DRAGON 32** at our **ROAD SHOWS** on **SUNDAYS - 12.30 to 4.30 p.m.**

NOV 21ST - YE OLDE FELBRIDGE HOTEL, NR.EAST GRINSTEAD, SUSSEX.
NOV 28TH - THE KINGS HEAD HOTEL, CARFAX, HORSHAM, SUSSEX.
DEC 5TH - THE PUNCHBOWL MOTOR HOTEL, REIGATE RD (A25) DORKING, SURREY.
DEC 12TH - THE CHEQUERS HOTEL, BRIGHTON RD (A23) HORLEY, SURREY.

SEND S.A.E.FOR CATALOGUE. PLEASE STATE THE COMPUTER TYPE

ORDER 2 OR MORE OF SOFTWARE FOR 7.5% DISCOUNT.
SPECIAL XMAS OFFERS
MAIL ORDER - Payment by cheque, P.O. Visa or Access.

26 BALCOME GARDENS, HORLEY, SURREY.
TEL: HORLEY (02934) 2007/6083

Access · AR · BARCLAYCARD VISA

ATOM

THE ATOM MAGIC BOOK
By Mike Lord. A wealth of games and other programs: storing speech in your ATOM, converting programs written in other BASICs, and many more useful software & *hardware* tips. £5.50

GETTING ACQUAINTED WITH YOUR ACORN ATOM
By Tim Hartnell & Trevor Sharples. 80 programs including draughts. £7.95

PRACTICAL PROGRAMS FOR THE BBC COMPUTER & ACORN ATOM
By David Johnson-Davies £5.95

ATOM CASSETTES
We stock a selection of the best: our latest being CAAD: Muncher + Mançala + Target + LIFE 7K. 4 great programs on one cassette for only £6.00

RAM FOR YOUR ATOM (Or other 1MHz 6502/68XX machine)
16 or 32 Bytes: expand your ATOM to 28 or 38K RAM, ideal for Word Processing, Chess programs & Business software. Compatible with other Atom software & hardware including the disc drive. To fit inside the ATOM or Eurocard rack mounting. Some types run from a single +5V supply. S.a.e. for details.

NEW!! ATOM ROAM BOARD MZ165 .... £35.00 inclusive
Allows software switching between up to 3 utility ROMs and also 4K RAM fitted so you can load your own 'utility' programs from tape or disc. Simple plugs into sockets on ATOM board.

All prices inclusive of U.K. P & P & VAT where applicable. Overseas customers please add £1.50 surface mail.

TIMEDATA Ltd. Dept A
57 Swallowdale, Basildon, Essex SS16 5JG
Tel: (0268) 411125 (Mon-Fri)

TIMEDATA

EXPLORING SPECTRUM BASIC
Mike Lord's latest book takes the reader beyond the Sinclair Manual. It contains a wealth of programs and explanations of Spectrum BASIC programming techniques. Topics include writing games programs, personal, business and engineering applications, and utility programs. Worth far more than £4.95

THE EXPLORERS GUIDE TO THE ZX81
Mike Lord's acclaimed book for the ZX81 enthusiast. Includes games, business, engineering and utility programs for both 1K and 16K machines, an introduction to Machine Language, with a list of useful ROM routines, hints & tips, and hardware notes including RAM and I/O circuits. "of the greatest value" (ZX Computing review) £4.95

MASTERING MACHINE CODE ON YOUR ZX81
By Toni Baker; 180 pages of immense value to beginner and expert alike. £7.50

All prices include U.K. P & P – no VAT on books. Overseas customers add £1.50 carriage per order.

TIMEDATA Ltd. Dept A
57 Swallowdale, Basildon, Essex SS16 5JG
Tel: (0268) 411125 (Mon-Fri)

VISA

TIMEDATA

SIR Computers Ltd.

Agents for Acorn, Dragon and Torch Computers

BBC Microcomputers

Model A	£299.00
Model A + 32K RAM	£339.00
Model B	£399.00
Model B + Disc interface	£479.00

BBC Compatible TEAC Disc drives

Single disc drive	£249.00
Dual disc drive	£459.00

Torch Disc unit

This is a complete package including a Z-80 processor, 64K RAM, Dual disc drive and the CP/N operating system — fully compatible with all existing CP/M software. Requires a disc-upgraded BBC Model B.

Torch disc pack	£1,149.00

Acorn ATOM

8K ROM + 2K RAM	£149.50
8K ROM + 12K RAM	£179.00
12K ROM + 12K RAM	£199.00
16K ROM + 12K RAM	£229.00
1.8 A Power supply	£8.50
ATOM Disc pack	£345.00

Dragon 32

Dragon 32	£189.00
Dragon joysticks (pair)	£19.00

All prices are inclusive of VAT

SIR Computers Ltd.
38 Dan-y-Coed Road, Cyncoed, Cardiff
Tel: (0222) 759015



ZX81 OWNERS

SPECIALISED PRODUCTS MODULAR EASY TO USE FOR HOME/INDUSTRY & EDUCATION

TE10 INPUT/OUTPUT PORT — Easy to use. Fits between ZX & RAM PACK/PRINTER (if required). No skill required to connect. Can be used for such things as:— motor control; sound/music generators, connection to printers/floppy discs/light pens/other computers, temperature monitoring, square wave generating, control of rotating aerials, even train sets etc. Port has 16 programmable 1/0 lines and may be used without any electronics knowledge to connect other add-ons. Motherboard required ONLY when two or more add-ons are used at any one time.

FULLY ASSEMBLED £17.95.
KIT (WITHOUT CASE) £14.95.

TE12 4 CHANNEL RELAY BOX — To suit Port Contact rating:— 240v AC/1,5A — 24V DC or 110V AC/3A. Up to 4 units i.e. 16 relays can be operated £14.95.

TE15 8 WAY TRANSISTOR DRIVER — £9.95

TE17 8 WAY SWITCH UNIT (EDUCATIONAL) — £12.95

TE18 8 WAY INDICATOR UNIT (EDUCATIONAL) — £12.95

TE20 JOYSTICK & FREE GAME — (2 Joysticks may be connected via Motherborsd.) £12.95

TE30 MOTHERBOARD — Allows multiples combinations of add-ons — up to 16 1/0 lines may be used — £15.95

TE126 POWER SUPPLY — 6/7.5/9V DC at 300 mA — Required for use with add-ons TE12/15 & 18 £4.95

23 + 23 WAY ZX Edge Con **£2.85.** Contact cleaner **£2.30.**
16 WAY SINGLE SIDED EDGE CON **£1.95.** EXTENDED PIO NOTES **£1.**

PRICES INCLUDE VAT

Receipts always provided: — Delivery normally ex-stock. ADD 50p towards p&p on all orders under £20.00, with the exception of accessories, e. g. Edge on. Full instructions and examples with all products.
SEND S.A.E. FOR CATALOGUE. TELEPHONE ORDERS ACCEPTED.

VISA

THURNALL (ELECTRONICS) ENG.
DEPT Y. 95 LIVERPOOL ROAD.
CADISHEAD. MANCHESTER M30 5BG
TEL: 061-775 4461 (24 hour)

reprints

If you are interested in a particular article/special feature or advertisement in this journal

HAVE A GOOD LOOK AT OUR REPRINT SERVICE!

We offer an excellent, reasonably priced service working to your own specifications to produce a valuable and prestigeous addition to your promotional material. (Minimum order 250 copies). Telephone Michael Rogers on 01-661 3036 or complete and return the form below.

To: Michael Rogers, Your Computer, Reprint Department, Quadrant House, Sutton, Surrey SM2 5AS.

I am interested in .... copies of article/advert.
headed .... featured in this
journal on pages ...., issue dated ....

Please send me full details of your reprint service by return of post.

Name ....
Company ....
Address ....
.... Tel No ....

PUT YOUR MICRO TO WORK!



CONTROL MACHINES, ROBOTS, FACTORY OR HOME

Have you ever wanted your MICRO to control a machine for you, or manage your house? If so, the MDR 'MICROCOMPUTER CONTROL INTERFACE' will give you isolated channels of OUTPUT (8A @ 250 volts) and switch sensing INPUTS.

Available now for connection to PET USER, PORT, RS232 and IEEE488, allowing expansion up to more than 900 channels.

Supplied complete with connecting cables, full data and guarantee from £12.54 per channel. Complete preprogrammed systems or individual components available. Write or phone for details.

M D R (INTERFACES) LTD.
Little Bridge House, Dane Hill,
Nr. Haywards Heath, Sussex RH17 7JD.
Telephone: 0825-790294.



An essential aid to all computer owners with Plot, Draw, Draw to a plotted co-ordinate etc., and medium/high resolution graphic capabilities, VICTAGRAPH gives you a fully adjustable window from plot 0,0 to plot 320, 200.

Higher resolution is possible by simple multiplication X2, etc., or reduction by division. Plot 0,0 in each corner to suit your requirements.

Place your drawing, tracing diagram etc., on a single sheet of paper and position in the VICTAGRAPH, AND you are ready to plot all the points quickly using the movable window AND easy to read scale.

Made from high quality plastic sheets, 17" × 12" approx.

Ideal for multi-graphic resolution computers such as Atari etc. Not suitable for Spectrum.

Total price £7.00. Cheques payable to: Victa Ceramics and crossed.

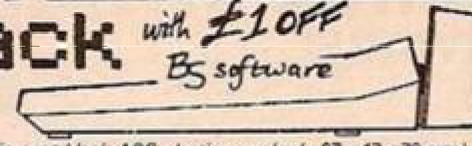
VICTA CERAMICS
6a BOW STREET, RUGELEY
STAFFS WS15 2BT.

Bridge Software

Dept. YC, 36 Fernwood,
Marple Bridge, STOCKPORT, Ches. SK6 5BE

RAM Pack

FOR THE ZX81



RAM packs fully assembled in neat black ABS plastic case (only 27×47×76 mm). Supplied with foam strip connector to improve mechanical stability. No annoying transformer hiss. Guaranteed. Fully compatible with ZX Printer. Sent by return, first class post.

16k RAM all-inclusive price £28.50

Buy from us with confidence!
We are proud of our reputation for quality and user-friendliness in service and software. Full money-back guarantee on all our products!

"Thank you once again for your prompt service; yours must be the most 'user-friendly' company in the business!" G.S. (Yorks.)
"I have bought numerous other items of software . . . Yours are excellent . . . the most user-friendly I have ever met." P.R. (Notts.)

Quality Software

for the ZX80, ZX81, Spectrum, BBC, VIC20

NEW **BRIDGEMAN** (BBC "B") £7.90
Bridge Software's version of the popular gobbler game. Hi-res, colour, sound.

NEW **LYNCHMOB** (ZX81 16k) £4.95
A competitive game for 2 to 6 players loosely based on Hangman. Animated graphics. Full on-screen scoring. Great fun, educational too.

NEW **LYNCHMOB** (ZX Spectrum 16k) £6.50
As for the ZX81, but developed to make full use of Spectrum's hi-res graphics, colour and sound.

VIC INVADERS (unexpanded VIC 20) £6.90
Machine code, colour, sound.

4k INVADERS (ZX81 4k minimum) £4.00
(GALAXY INVADERS) Machine code, 10 difficulty levels. Top scoring game in Your Computer's May 1982 review of ZX81 software. "Deservedly popular . . . Good value" Pop. Comp. Weekly. "Great game!" S.F. Glos.

SUPER INVADERS (ZX81 16k) £4.95
Enhanced version of 4k INVADERS, including on-screen league tables etc.

MULTIGRAPHICS 2.3 (ZX81 16k) £6.90
A user-friendly menu-driven package of procedures giving you full control of the ZX81 graphics functions to compose designs, drawings, adverts etc. Incorporates advanced sketchpad, 3 sizes of text (including lower case), animation, printer output, SAVE displays etc. 20 pp. Manual included.

NEW **STATISTICS** (Spectrum 16k, 48k) Mean, SD, variance, regression, t, F tests. Full graphics. Send s.a.e. for details.

NEW **EPHEMERIS** (ZX81 16k) . . . £6.90 (Spectrum 16k) . . . £7.90
Interested in heavenly bodies? Input date, time and your position, Ephemeris computes altitude, azimuth, phase etc. etc. for sun, moon and planets.

ZX81 1k GRAPHICS, 1k STATISTICS Send s.a.e. for details.

Send s.a.e. for further details, specifying Your Computer.
Prices include 1st class, return-of-post mail in U.K.
European customers please add 30p. per software item; 70p worldwide (Air Mail).
Overseas customers, please write for details of hardware mailing charges.
Available by mail order or from leading computer stores. Trade enquiries welcome.

LEON NOEL

ZX81 16K — GAMES ON TAPE

☐ **BANK ROBBER £4.50**
SEE HOW MUCH MONEY YOU CAN ACCUMULATE BEFORE YOU'RE CAUGHT AND SENT TO JAIL

☐ **PONTOON £4.50**
CAN YOU GET YOUR COMPUTER TO OWE YOU MONEY, NOT EASY, BUT IT CAN BE DONE

☐ **HANGMAN £4.00**
WITH THIS EDUCATIONAL GAME YOUR COMPUTER WILL HAVE 150 WORDS TO CHOOSE FROM

☐ **CASSETTE COVER £4.00**
PUT YOUR ZX PRINTER TO WORK AND MAKE YOUR PROGRAM COLLECTION LOOK IMPRESSIVE
*CHOICE OF SIX COVER PATTERNS

PLEASE TICK APPROPRIATE BOX(S)

MAIL ORDER ONLY
NAME ....
ADDRESS ....
....
.... CODE ....

I enclose Cheque/P.O. for £ ....
Made payable to:

LEON-NOEL
24 Dudgeon Drive, Littlemore Oxford
OX4 4QL

ALL PRICES INCLUDE P&P, UK ONLY

THE

BUFFER

MICRO SHOP

(NEXT TO STREATHAM STATION)

NEW SOFTWARE SHOP EXCLUSIVELY FOR

ZX81

PROGRAMS, GAMES, "ADD-ONS"

MOST OF THE MAIL ORDER ITEMS ADVERTISED IN THIS MAGAZINE AVAILABLE OVER THE COUNTER

LOADING PROBLEMS? TRY OUR INTERFACE
BUSINESS & TECHNICAL DATA HANDLING PROGS;
PROPER KEYBOARDS; CONSOLES; VDUs

The BUFFER Micro Shop,
374a Streatham High Road,
London SW16
Tel: 01-769 2887

SOFTWARE FOR BBC, TRS-80 AND GENIE from DAVANSOFT

WIN THE POOLS?

With the latest version of D S Peckett's well-known Pools Prediction program. Now available for BBC Micro (needs 32K memory) as well as the TRS-80 (LII) and Video Genie.

Program and instructions £4.95
Database tape (optional, but holds data on over 6000 matches) £13.50
Program and DB together £17.50

baby PILOT

Easy-to-use, friendly and very fast version of this important teaching language. All normal PILOT I/O and control commands PLUS integer arithmetic, powerful graphics and formatting commands, "FOR. . .NEXT" loops, subroutines, automatic scoring and other extra features.

Add another language to your TRS-80 or Genie — complete and simple-to-follow instructions included.

baby PILOT £9.95

BBC Disassembler

Now — your chance to find out how the BBC Micro's ROM works, and to study those machine-language games. A full 6502 disassembler, with automatic labelling of branches, jumps, etc and with the ability to avoid trying to disassemble data areas. Has optional hard copy function as well as the load facility to dump the disassembly to tape, for later LOADing and modification.

This package is indispensable to the serious machine-code programmer, and is suitable for Models A and B.

BBC Disassembler £5.95

All these prices are fully inclusive and are for cassette-based programs only.

DAVANSOFT
1 DELAPOER DRIVE, HAVERFORDSWEST
DYFED SA61 1HX

We are always looking for high-quality programs for TRS-80, VG and BBC computers, and will pay up to 30% royalties for suitable material. Please contact us with your proposals or for details of our requirements.


MORE MEMORY FOR MICROS!
look at what we can offer:
RAMPACKS
for SINCLAIR ZX81
VCS 8K for VIC
8k RAM+3 slots £44
DUO1 for ATOM
64k RAM only £70
16K - the only upgradable to 56k on the market - £36
OUT OF STOCK
add up to 20k RAM+16k ROM
VCR 20 for VIC
4K-£24, 2k increment-£5
DRC for PET
64K-£80 128K-£130
32K bytes — £29
TRS80-V.GENIE
32K add on RAM £46
UK101:
32K add on RAM £69
FOR A FREE BROCHURE, RING LINDA OR SUE ON SOUTHEND (0702) 613081
FOR CREDIT CARD ORDERS, RING JACKIE OR PAM ON SOUTHEND (0702) 618144
CHEQUES AND P.O.'s TO:
AUDIO-COMPUTERS
87 BOURNEMOUTH PARK ROAD, SOUTHEND ON SEA — ESSEX SS5 2JJ
ALL PRICES INCLUDE V.A.T. AND POSTAGE
56K — exceptional low power consumption — £44.90
64K + Eprom programmer & user port — only £79
TELEX 995337 G AUDCOM
We can adopt the above products for ZX81 to fit your new Spectrum for just £5 Extra.
A TRADEMARK OF SOLIDISK LTD

Spectrum Software

SPECTRUM
VIDEO PACK
includes all of: —

- POLECAT
  maze video game
- CITY BOMBER
- BREAKOUT
- FRUIT MACHINE
- LUNAR LANDER
- CRAZY RACE
- SUBHUNT
- MISSILE COMMANDER
- SPECIAL PRICE

£5.00 INC!
FOR ALL 8



BBC
SOFTWARE
While stocks last!!

LUNAR LANDER
£4.00 INC

EARLY WARNING
£4.00 INC

ZX81 — Software

NEW

THE **ZX·16K·81** GAMES / £5-00 inc VAT + P/P
4 MAGNIFICENT MACHINE CODE GAMES ALL ON TAPE



C ☆ TECH Software

184 MARKET STREET
HYDE, CHESHIRE

ALL PRICES INCLUDE VAT AND P&P.

48 hr
DESPATCH
GUARANTEED

Please send me as soon as possible the following:
☐ ________________ £____
☐ ________________ £____
I enclose a Cheque/P.O. for the total £____
NAME ________________
ADDRESS ________________
________________ POSTCODE ________